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XM746 PRACTICE FUZE.(U)
1979 DAAK10-79-C-0040
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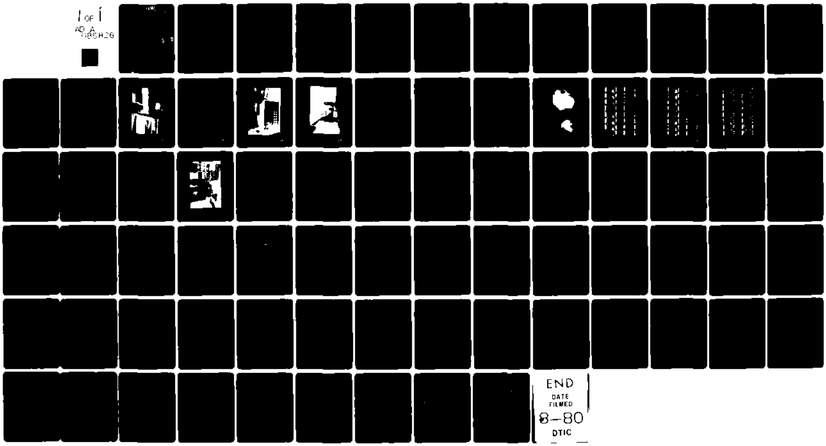

LEVEL II

XM746 PRACTICE FUZE.

Progress Report. no. 2

1 Mar[redacted]-28 Sep[redacted]979.

Progress Report No. 2

Contract No. DAAK10-79-C-0040

Prepared for:

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U. S. Army Armament Research and
Development Command
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1.0 INTRODUCTION

This progress report covers the period 1 March to 28 September, under contract no. DAAK10-79-C-0040. This program is for the Design and Development of the XM746 Practice Fuze Spotting Charge.

1.1 Background

In March the requirements for a settable ogive were dropped, which allowed the use of the standard PDM 739 Fuze, modified to the XM747 Fuze. Also, the visible range for the spotting charge was increased 2000m - from 2000m to 4000m.

Tests of 3 candidate spotting charges were conducted at Yuma Proving Grounds (YPG) in April and at Ft. Sill in June to select the most suitable charge for the XM747 Fuze; however, due to dust clouds created on impact at YPG, the signature tended to be obscured. At Ft. Sill, 2.6 inches of rain fell on the impact area the day before, resulting in an extremely soft and muddy impact area. The smoke signal from the fuze impact was smothered by the impact medium and the signal was either minimal or not visible. Due to the above, a full determination could not be made but the results indicated additional development was necessary.

1.2 Design Modifications

As a result of the YPG and Ft. Sill tests, two design modifications to improve the spotting charge display were decided to be worth development and evaluation:

- Drilling of four 1/2 inch holes toward the rear of the projectile to allow smoke exit ports to be exposed to the atmosphere for a longer period of time (about 2-milliseconds) before being buried in the impact medium.

- Modify the granulation and ignition systems of the candidate pyrotechnic compositions to reduce functioning times.

1.3 Static Testing at MBA

Static testing of a matrix of the modified designs was conducted over an 8 day period starting on 9 September.

1.3.1 Object of Test

The primary object of the test was to determine function time, smoke cloud size and duration of Ordnance Research Inc. (ORI) type B & type C charges, ARRADCOM MOD E and MOD E1 charges and the MBA improved TiCl4/ ~~$TiCl_4$~~ ARRADCOM MOD E charge. ~~See Table~~ 1 for compositions. Based on the test results, the best performing ORI and ARRADCOM configuration was to be carried forward for ballistic range testing at Ft. Lewis. In the case of the MBA design, it would be carried forward only if the function time was fast enough to indicate a reasonable probability of success. As discussed below, the function time was adequate to justify continued development.

1.3.2 Hardware

The hardware used in the testing was the M107 (155mm) Projectile and XM747 Fuze. The GFE fuzes were received with six .437 dia. holes. The holes were taped ½-20 and screws were used as necessary, see Figure 1, to meet the test plan for 0, 3 & 6 holes in the fuze. The projectile had four .500 holes drilled radial into the body 7.500 in. from the base, see Figure 2.

MBA blended the ARRADCOM composition MOD E and E1 and loaded the composition into GFE plastic containers, see Figure 3, to ARRADCOM specifications. See Table 2 and attachments A & B for blending and loading records.

Two $TiCl_4$ container designs were considered and identified as configuration A & B. The A configuration was rejected due to the fact it projected beyond the rear of the fuze, see Figure 4, which would cause packaging problems in the event of a future production program. The B configuration is contained within the fuze body, see Figure 5. To accomplish this, it was necessary to reduce the $TiCl_4$ charge from 22cc to 18cc and reduce the expulsion charge from 47 to 27 grams relative to the A configuration. The charge container length was also reduced by 3/4 in.

ORI supplied their spotting charge ORI "B" and "C" in sealed containers for the test.

TABLE 1

DESCRIPTION OF
PYROTECHNIC SMOKE COMPOSITIONS

MOD E:

Ingredient	% by Wt	Spec
Zinc Dust	40 $\pm$ 1	JAN-Z-365
Potassium Perchlorate	20 $\pm$ 0.5	MIL-P-217A, GrA, C14
Potassium Nitrate	20 $\pm$ 0.5	MIL-P-15613 C1 2
Aluminum (Atomized)	20 $\pm$ 0.5	MIL-P-14067A Type II

MOD E1 as above except for MDF DET Core, see Figure 3.

ORI B - Proprietary Red Phosphorous Composition

ORI C - Proprietary Red Phosphorous Composition

MBA*

Titanium Tetrachloride

SPECIFICATIONS (Weston, Michigan Plant)

Titanium, wt. %	25.0 minimum
Chlorine, wt. %	74.0 minimum
Color	50 maximum

Metal Analysis, ppm

Tin (Sn)	10 max.	Chromium (Cr)	5 max.
Aluminum (Al)	10 max.	Antimony (Sb)	5 max.
Iron (Fe)	15 max.	Arsenic (As)	10 max.
Vanadium (V)	10 max.	Lead (Pb)	1 max.
Silicon (Si)	10 max.	Nickel (Ni)	5 max.
Copper (Cu)	5 max.		

MOD E - 47 gms. Composition per above

*

ARRADCOM MOD E charge used as $TiCl_4$ expulsion charge

TABLE 1 (Continued)

TITANIUM TETRACHLORIDE - $TiCl_4$*

PHYSICAL PROPERTIES

Chemical Formula	$TiCl_4$
Molecular Weight	189.7
Color, Form	clear liquid
Melting Point	-30°C
Boiling Point	136.4°C
Specific Gravity (20°C)	1.726
Density (lbs./gal.)	14.4
Stability	decomposes in the presence of moist air

SPECIFICATIONS (Weston, Michigan Plant)

Titanium, wt.%	25.0 minimum
Chlorine, wt.%	74.0 minimum
Color	50 maximum

Metal Analysis, ppm

Tin (Sn)	10 max.	Chromium (Cr)	5 max.
Aluminum (Al)	10 max.	Antimony (Sb)	5 max.
Iron (Fe)	15 max.	Arsenic (As)	10 max.
Vanadium (V)	10 max.	Lead (Pb)	1 max.
Silicon (Si)	10 max.	Nickel (Ni)	5 max.
Copper (Cu)	5 max.		

SAFETY AND HANDLING

Titanium tetrachloride must be maintained under inert atmosphere. Nitrogen containing less than 10 ppm oxygen is recommended. Exposure to moisture in the air generates hydrochloric acid and titanium dioxide. Refer to the titanium tetrachloride "Product Safety Information" sheet for safety information, and to the Stauffer brochure "A Guide to Cylinder Unloading."

*Copied from Stauffer Chemical Co's Product Data Sheet

TABLE 1A

SENSITIVITY COMPARISON OF PYROTECHNIC SMOKES

CHARACTERISTIC	COMPOSITION SW 522	ORI 'B'	ORI 'C'
Vacuum Stability: Gas Evolved - ML	0.92 40 Hrs @ 120°C	1.88 40 Hrs @ 100°C	11+ Failed - Stopped After 16 hours
Impact Test: (Bruceton 50% F.P.) 2.5 Kg Wt Drop Ht (cm) Std Ball Drop (Prim Expl) (cm)	198	96.5*	51*
Friction Pendulum: Fiber Shoe	No Action	Detonates	Burns
Steel Shoe	Cracks, Sparks, Partial Detonation	Burns, Detonates	Cracks, Burns
Electrostatic Sensitivity: @ 0.25 Joules	No Ignition 20 Tries	Ignites Between 0.025 & 0.25 Joules (Failed)**	No Ignition 20 Tries
Ignition Temp: DTA 10°C/Minute Up to 227°C	No Ignition To 700°C Even @ 20°C/Min	No Ignition (In Argon)	Endotherm 54°C Endotherm 64-84°C Endotherm 104-129°C (In Argon)

* Value for RD 1333 Lead Azide is 48-56 CM.

** 0.025 Joules can be carried on human body

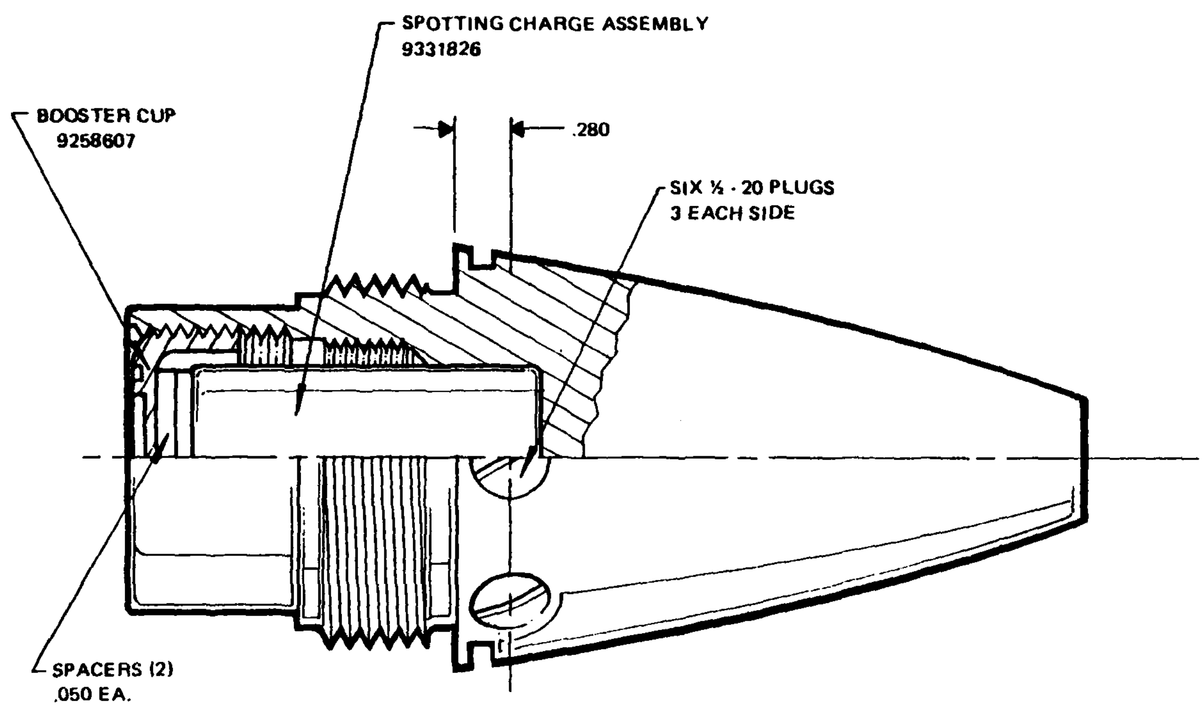


FIGURE 1
XM747 FUZE BODY

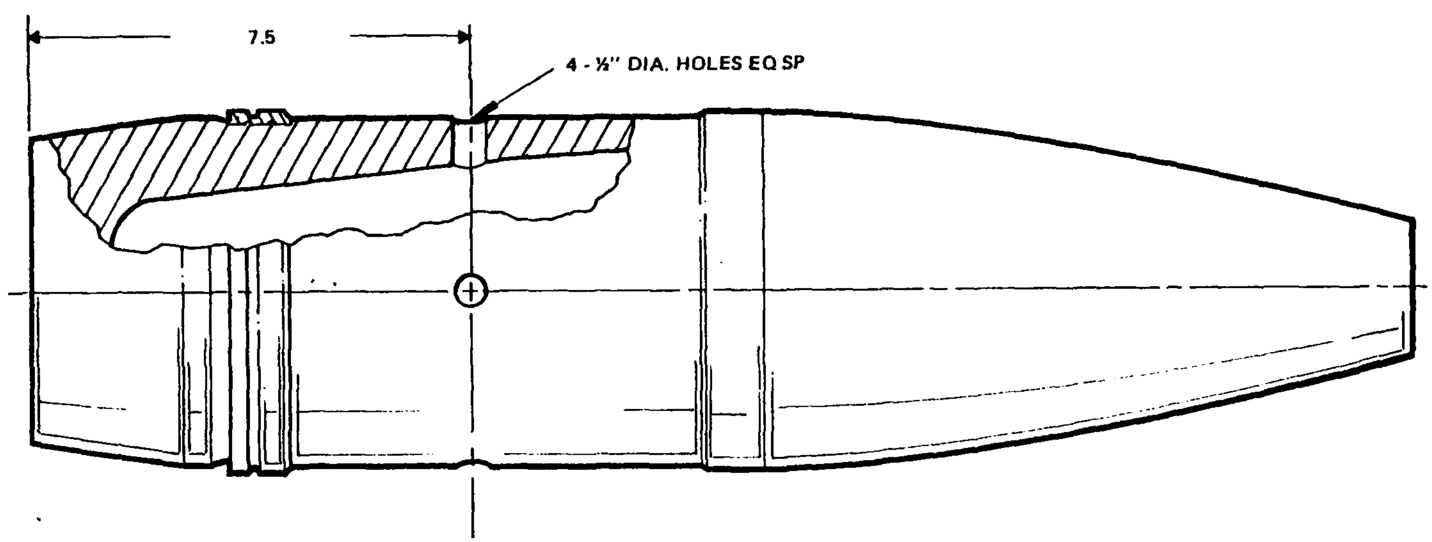
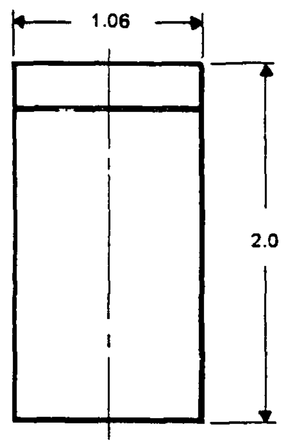
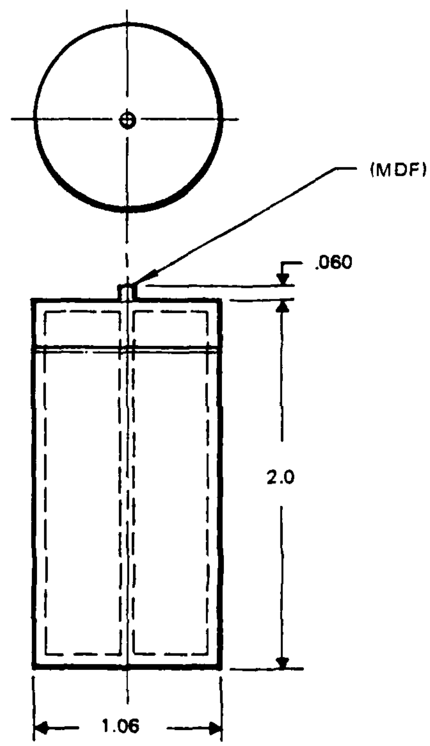


FIGURE 2
M107 (155mm) PROJECTILE



MOD E CONTAINER



MOD E1 CONTAINER

FIGURE 3
ARRADCOM CONFIGURATION

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TABLE 2

NOTES:

1. Spec MIL-A-2550 Applies.

2. Load with approximately 48 grams ARRADCOM smoke composition, MOD E, as follows:

INGREDIENT	% BY WT.	PARTICLE SIZE (MICRONS)	SPEC
Zinc Dust	40 ± 1	7 ± 3	JAN-Z-365
Potassium Perchlorate	20 ± 0.5	Per spec	MIL-P-217A, GRA, CL 4
Potassium Nitrate	20 ± 0.5	30 ± 15	MIL-P-156B, CL 2
Aluminum (Atomized)	20 ± 0.5	Per spec	MIL-P-14067A, Type II

3. Advisorv: Blend Smoke Composition Ingredients Use Globe or Ball Mill Equipment.

4. Compact Charge, Spotting by Vibrating or Tamping in Cup, Spotting Charge, 9331828.

5. Secure Cover to Cup with 2 part Epoxy.

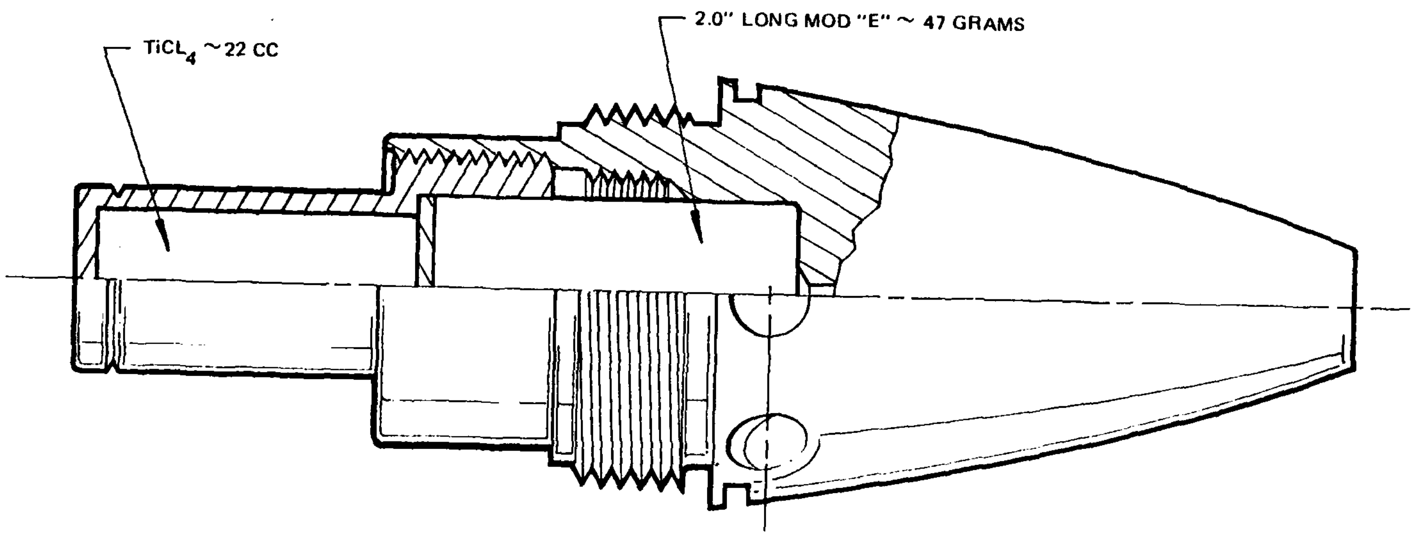

FIGURE 4
TiCL$_4$/MOD "E", CONFIGURATION "A"

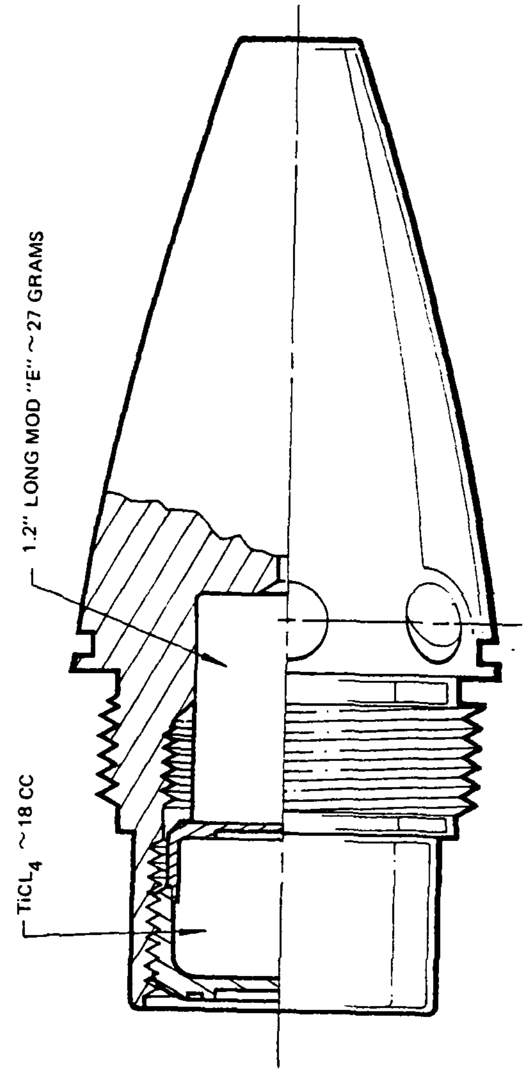

FIGURE 5
$TiCL_4$/MOD "E", CONFIGURATION "B"

1.3.3 Testing

A total of 54 tests of the various spotting charges and smoke port configurations were conducted, see Table 3 for Test Plan. The fuzes were assembled to the M107 projectile, placed in a test fixture and fired with an electric squib, see Figure 6.

ARRADCOM and Ft. Sill representatives witnessed the test series and evaluated the spotting charges and hardware configurations.

1.3.4 Instrumentation and Equipment

a. Molectron Model PR-100 electric radioment, amplifier and a CIC Model 5-124 recording oscillograph for energy output of the spotting charge.

b. Hy Cam Hi Speed 16mm camera to record function times.

c. Scoopic 16mm camera for film coverage of the testing.

d. Velocity screens to a digital counter for instantaneous function time read out, see Figure 7 for typical hook-up.

e. Agastat step timer to control function times between cameras and fuze detonation. See Figure 8.

f. Walk-in oven for temperature conditioning of fuzes to $-30^{\circ}F$ and $+130^{\circ}F$ for 12 hours, see Figure 9.

1.3.5 Test Summary

The first 11 tests were devoted primarily to selecting the best ARRADCOM and ORI spotting charge configuration.

The fuzes were assembled as shown in Figure 1 except the 6 holes were not plugged. Based on previous designs, 2-.050 steel spacers were placed between the booster cup and the spotting charge to prevent rupturing the booster cup base. This was done to insure expelling the total charge out of the fuze ports.

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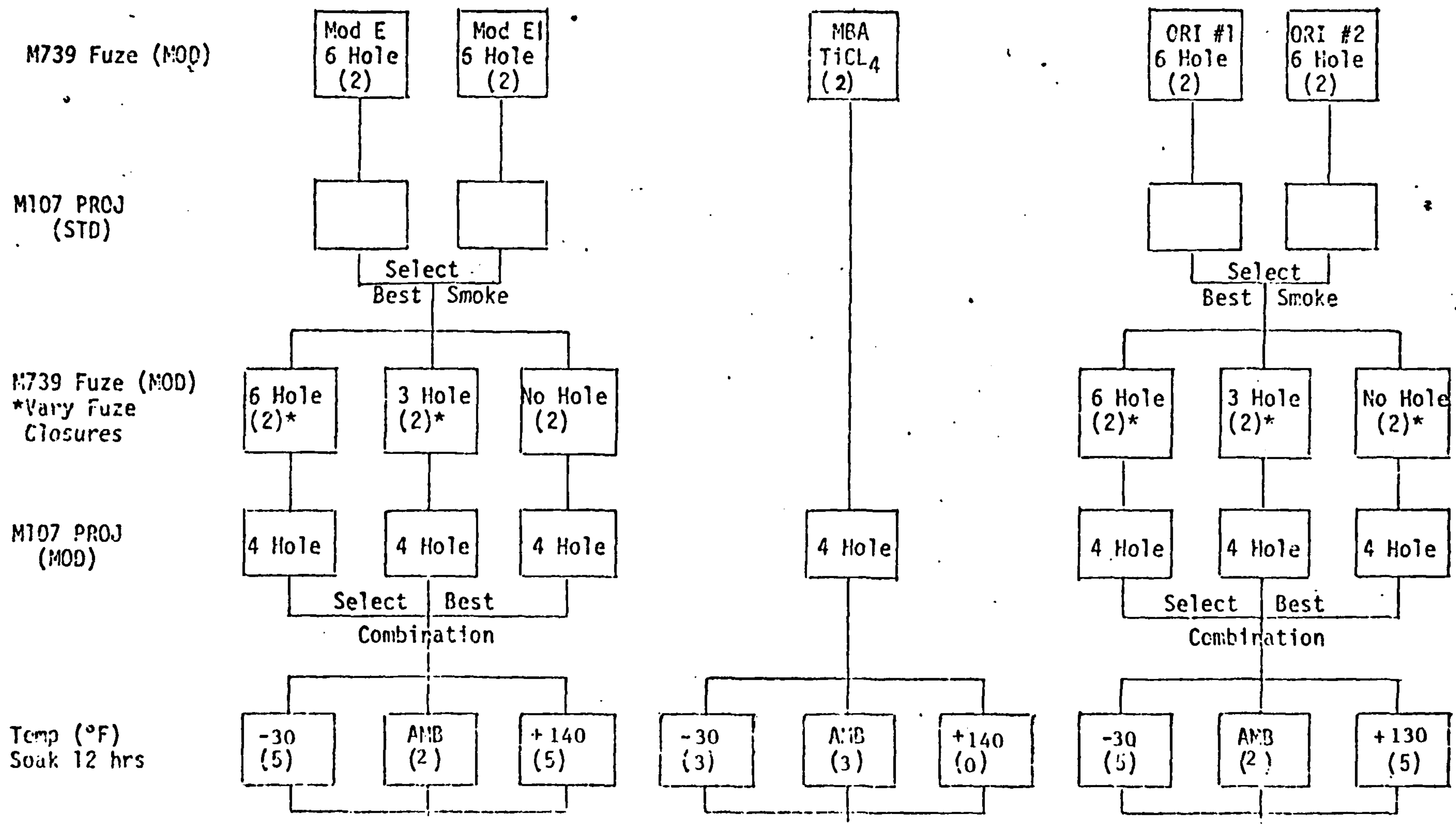
STATIC TEST PLAN (MBA)

FUZE, PD, PRACTICE, XM747

TABLE 3



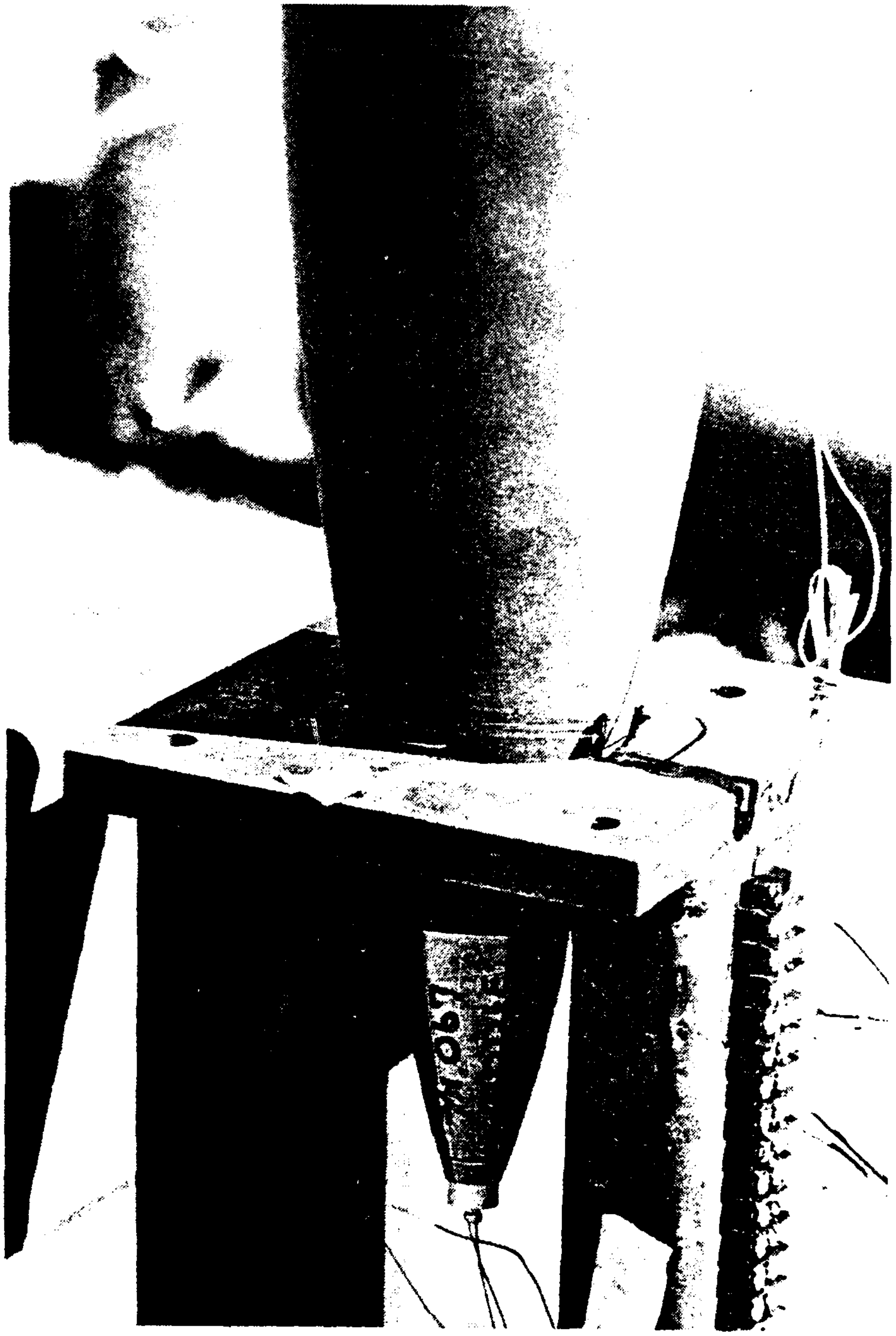


FIGURE 6
TYPICAL TEST SET UP

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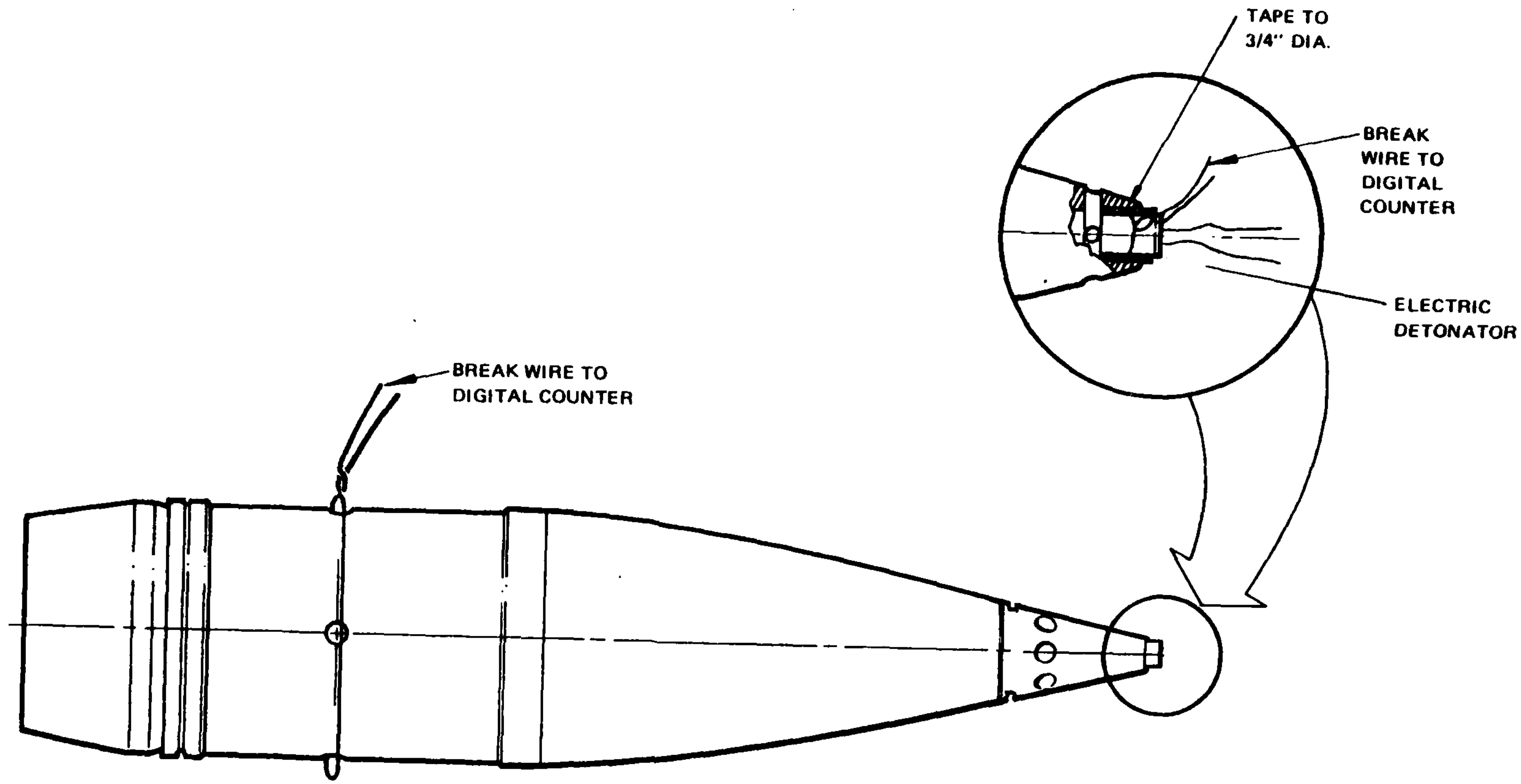

FIGURE 7
TYPICAL VELOCITY SCREEN

MBA
3029-16857

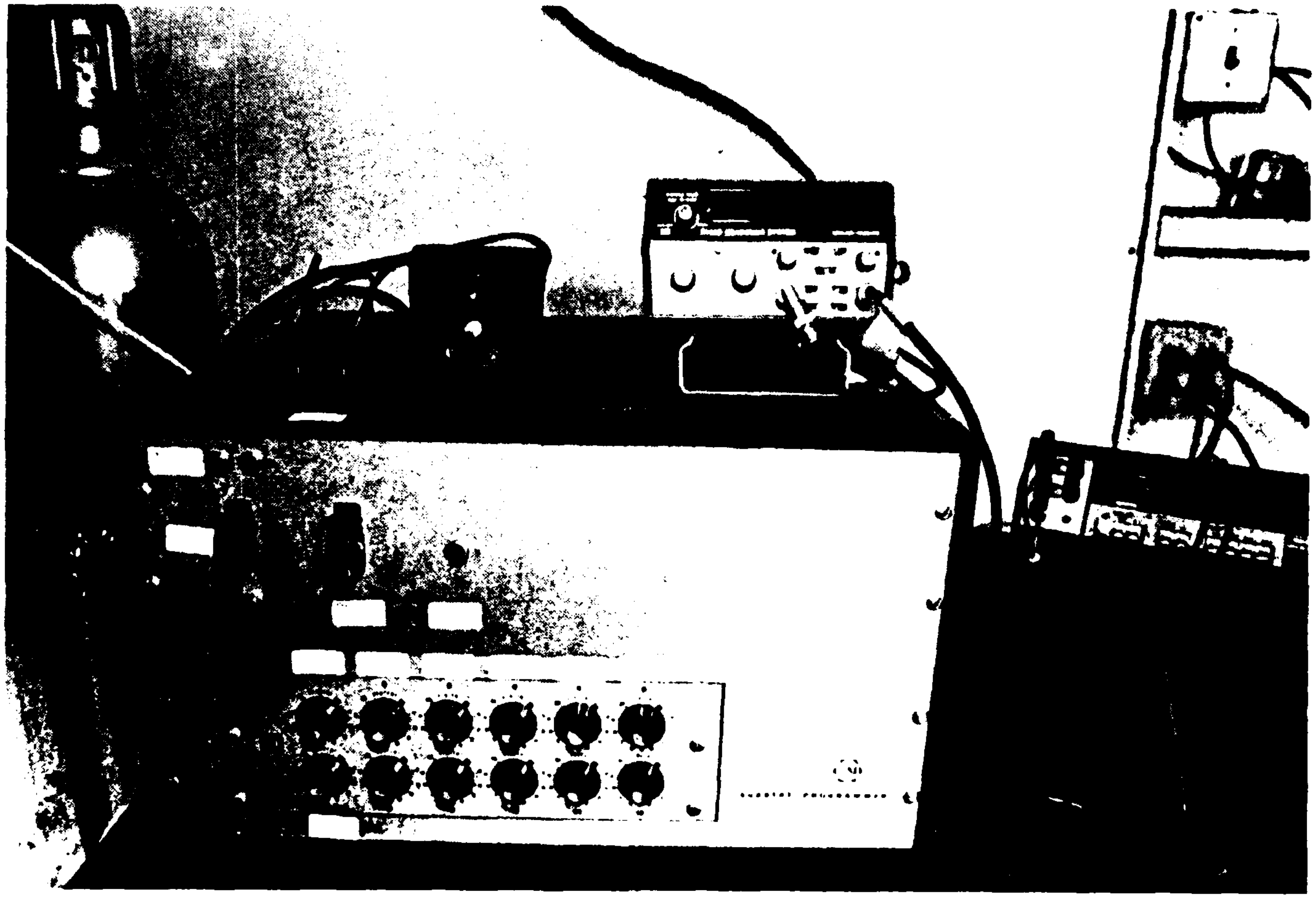

FIGURE 8
TEST CONTROL MODULE

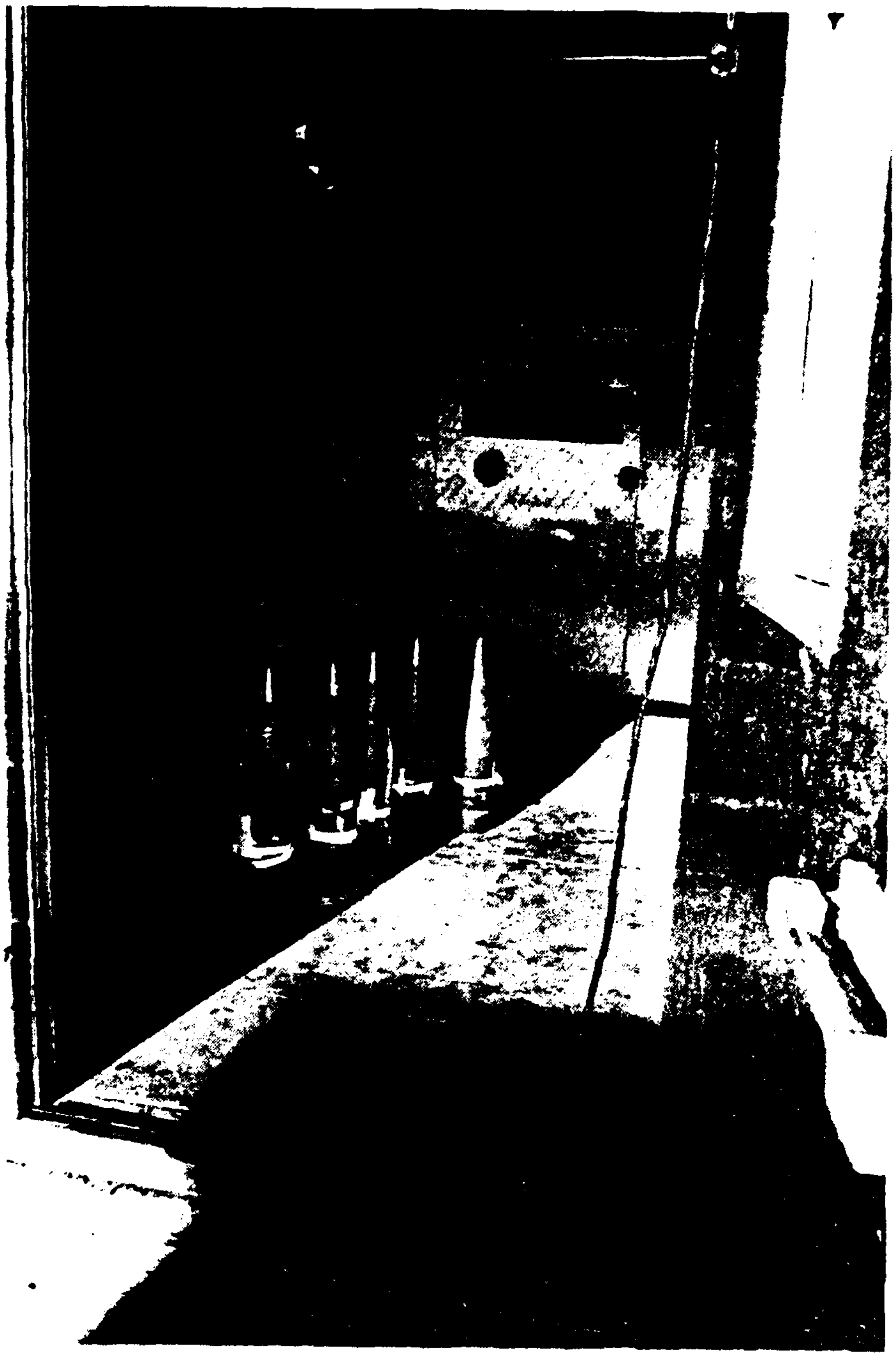

FIGURE 9
WALK IN OVEN

MBA
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TABLE 4

STATIC TESTING PRACTICE FUZE SM747

DATE	DESCRIPTION	TEST No.	SR No.	FUZE TEMP °F	SPOTTING CHARGE	CHARGE VOL CC/wtGM	TIME MS FUZE BW	TIME MS FUZE FILM	TIME MS PROJ BW	TIME MS PROJ FILM	REMARKS
6-11	6 Hole Fuze - 0 Holes Proj.	1	020	AMB	MOD "E"	44.11	.138	-	-	-	
6-11	6 Hole Fuze - 0 Holes Proj.	2	021	AMB	MOD "E1"	46.95	.195	-	-	-	*Fuze did not function
6-11	6 Hole Fuze - 0 Holes Proj.	3	024	AMB	MOD "E1"	46.3	.173	-	-	-	
6-11	6 Hole Fuze - 0 Holes Proj.	4	022	AMB	ORI "C"	-	.180	-	-	-	
6-11	6 Hole Fuze - 0 Holes Proj.	5	023	AMB	ORI "B"	-	.706	-	-	-	
6-11	0 Hole Fuze - 4 Hole Proj.	6	025	AMB	TICL4/ MOD"E1"	22/46.6	-	-	2.69	-	
9-12	6 Hole Fuze - 0 Hole Proj.	7	026	AMB	MOD "E"	46.6	.188	-	-	-	Configuration "A" cont.
9-12	6 Hole Fuze - 0 Hole Proj.	8	027	AMB	MOD "E1"	47.15	1.32	-	-	-	
9-12	6 Hole Fuze - 0 Hole Proj.	9	028	AMB	ORI "B"	-	.191	-	-	-	
9-12	6 Hole Fuze - 0 Hole Proj.	10	029	AMB	ORI "C"	-	.191	-	-	-	
9-12	6 Hole Fuze - 0 Hole Proj.	11	030	AMB	MOD "E1"	45.7	.174	-	-	-	
9-12	6 Hole Fuze - 4 Hole Proj.	12	031	AMB	MOD "E"	49.0	-	-			Booster cup did not rupture
9-12	3 Hole Fuze - 4 Hole Proj.	13	033	AMB	MOD "E"	46.85	-	-			Booster cup did not rupture
9-12	0 Hole Fuze - 4 Hole Proj.	14	035	AMB	MOD "E"	46.9	-	-			*Fuze did not function
9-12	6 Hole Fuze - 4 Hole Proj.	15	032	AMB	MOD "E"	46.5	-	-			Booster cup did not rupture
9-12	0 Hole Fuze - 4 Hole Proj.	16	043	AMB	TICL4/ MOD"E"	22/47.45	-	-			*Fuze did not function Configuration "A" container
9-13	3 Hole Fuze - 4 Hole Proj.	17	039	AMB	ORI"C"	-	-	.143			Booster cup did not rupture
9-13	0 Hole Fuze - 4 Hole Proj.	18	041	AMB	ORI"C"	-	-	-	-	11.2	
9-13	0 Hole Fuze - 4 Hole Proj.	19	042	AMB	ORI"C"	-	-	-	-	5.07	
9-13	3 Hole Fuze - 4 Hole Proj.	20	034	AMB	MOD "E"	47.55	-	.250	1.678	2.40	
9-13	0 Hole Fuze - 4 Hole Proj.	21	036	AMB	MOD "E"	46.85	-	-	2.160	2.43	
9-13	0 Hole Fuze - 4 Hole Proj.	22	044	AMB	TICL4/ MOD"E"	22/47.5	-	-	2.371	-	Fuze failed at ports Configuration "A"
9-13	0 Hole Fuze - 4 Hole Proj.	23	046	AMB	MOD "E"	46.6	-	-	2.691	-	Fuze failed at ports
9-13	0 Hole Fuze - 4 Hole Proj.	24	045	AMB	TICL4/ MOD"E"	22/47.5	-	-	-	1.84	Configuration "A" container
9-17	0 Hole Fuze - 4 Hole Proj.	25	061	$-50^{\circ}F$	ORI"C"	-	-	-	8.591	9.04	
9-17	0 Hole Fuze - 4 Hole Proj.	26	063	$-50^{\circ}F$	ORI"C"	-	-	-	6.036	6.57	
9-17	0 Hole Fuze - 4 Hole Proj.	27	047	$-50^{\circ}F$	MOD "E"	45.75	-	-	2.495	2.79	*Interrupt not in proper position

TABLE 4 (contd.)

STATIC TESTING PRACTICE FUZE SM747

DATE	DESCRIPTION	TEST No.	SR No.	FUZE TEMP °F	SPOTTING CHARGE	CHARGE VOL CC/$_{wtGM}$	TIME MS FUZE BW	TIME MS FUZE FILM	TIME MS PROJ BW	TIME MS PROJ FILM	REMARKS
9-18	0 Hole Fuze - 4 Hole Proj.	28	059	-30°F	ORI"C"	-			6.00	9.57	
9-18	0 Hole Fuze - 4 Hole Proj.	29	062	-30°F	ORI"C"	-			-	7.95	
9-18	0 Hole Fuze - 4 Hole Proj.	30	060	-30°F	ORI"C"	-			7.747	8.09	
9-18	0 Hole Fuze - 4 Hole Proj.	31	053	-30°F	MOD"E"	47.05			2.496	2.67	
9-18	0 Hole Fuze - 4 Hole Proj.	32	052	-30°F	MOD"E"	46.25			1.620	1.79	
9-18	0 Hole Fuze - 4 Hole Proj.	33	051	-30°F	MOD"E"	48.45			2.232	2.34	
9-18	0 Hole Fuze - 4 Hole Proj.	34	050	-30°F	MOD"E"	47.65			2.065	2.31	
9-18	0 Hole Fuze - 4 Hole Proj.	35	058	-30°F	TICL4/ MOD"E"	22/45.15			2.853	3.21	Configuration "A" container
9-18	0 Hole Fuze - 4 Hole Proj.	36	057	-30°F	TICL4/ MOD"E"	22/45.9			-	4.07	Configuration "A" container
9-18	0 Hole Fuze - 4 Hole Proj.	37	055	-30°F	TICL4/ MOD"E"	22/47.5			-	2.55	Configuration "A" container
9-20	0 Hole Fuze - 4 Hole Proj.	38	076	+140°F	ORI"C"	-			-	-	
9-20	0 Hole Fuze - 4 Hole Proj.	39	078	+140°F	ORI"C"	-			5.908	6.10	
9-20	0 Hole Fuze - 4 Hole Proj.	40	075	+140°F	ORI"C"	-			5.061	5.29	
9-20	0 Hole Fuze - 4 Hole Proj.	41	074	+140°F	ORI"C"	-			5.520	5.94	
9-20	0 Hole Fuze - 4 Hole Proj.	42	077	+140°F	ORI"C"	-			6.661	7.06	
9-21	0 Hole Fuze - 4 Hole Proj.	43	066	+140°F	MOD"E"	48.75			1.223	1.41	
9-21	0 Hole Fuze - 4 Hole Proj.	44	068	+140°F	MOD"E"	45.75			1.892	2.15	
9-21	0 Hole Fuze - 4 Hole Proj.	45	067	+140°F	MOD"E"	46.05			2.922	3.80	
9-21	0 Hole Fuze - 4 Hole Proj.	46	070	+140°F	MOD"E"	49.55			2.180	2.30	
9-21	0 Hole Fuze - 4 Hole Proj.	47	069	+140°F	MOD"E"	46.95			2.746	2.93	
9-28	0 Hole Fuze - 4 Hole Proj.	48	079	AMB	ORI"C"	-				5.59	
9-28	0 Hole Fuze - 4 Hole Proj.	49	080	AMB	ORI"C"	-				6.28	
9-28	0 Hole Fuze - 4 Hole Proj.	50	064	AMB	MOD"E"	47.10				1.64	
9-28	0 Hole Fuze - 4 Hole Proj.	51	065	AMB	MOD"E"	47.05				1.81	
9-28	0 Hole Fuze - 4 Hole Proj.	52	086	AMB	TICL4/ MOD"E"	18/27.86				2.40	Configuration "B" container
9-28	0 Hole Fuze - 4 Hole Proj.	53	087	AMB	TICL4/ MOD"E"	18/26.95				2.62	Configuration "B" container
9-28	0 Hole Fuze - 4 Hole Proj.	54	088	AMB	TICL4/ MOD"E"	18/27.05				3.22	Configuration "B" container

NOTE: ORI"C" & MOD"E" ALL DISPLAYED GOOD SMOKE AND FLASH.
TICL4/MOD"E" EXCELLENT SMOKE FOR LONGER DURATION. GOOD FLASH.

Based on visual observations, review of the 16mm film and examination of function time data, see Table 4, ARRADCOM's MOD E was selected over the MOD E1. It was apparent the mild detonating fuze (MDF) did not improve function time. ORI "C" was selected primarily on the basis of more smoke than ORI "B" composition.

A series of tests were conducted to verify the distribution of the spotting charge output between the fuze and projectile ports (see Tables 3 and 4). It was also necessary during this test series to determine the need, if any, for a .050 steel spacer to slightly delay the rupturing of the booster cup and distribute the spotting charge between the fuze and projectile ports. During tests 12, 13, 15 & 17, see Table 4, the booster cup did not rupture as planned. Based on these results, it was concluded that the .050 spacer be removed for all future tests.

Tests no. 18 thru 24 with the 6 fuze ports blocked off, 5 of the cups ruptured, see Figure 9, and 2 of the fuze bodies (tests 22 and 24) had tensile failure in the area of smoke port, see Figure 10. The failure was attributed to the modification of the fuze (the addition of 6 smoke ports) which removed about 70% of the material in the area of the failure.

As a result of the above test failures it was decided that the balance of testing be conducted with unmodified PDM739 fuzes (without six .437 dia. holes).

The balance of the testing went relatively problem free with only minor instrument problems.

In comparing ORI "C" and MOD "E" cloud size and duration, no major difference could be seen; however, the flash seemed to be more intense coming from the ORI "C" charge. The MBA $TiCl_4$/MOD "E" cloud, when compared to OR "C" and MOD "E", was much more intense and its duration considerably longer, in the order of 15-20 sec. compared to about 5-10 sec. The film clips in Figure 11, A, B & C, show the typical spotting charge of the MOD "E", ORI "C" and MBA $TiCl_4$ exiting from the rear of the projectile shortly after fuze function (MOD "E" at 10.0 MS, ORI "C" 14.0 MS and MBA $TiCl_4$ 11.0 MS).

FIGURE 10
TYPICAL BOOSTER CUP RUPTURE

FIGURE 11
FUZE BODY FAILURE

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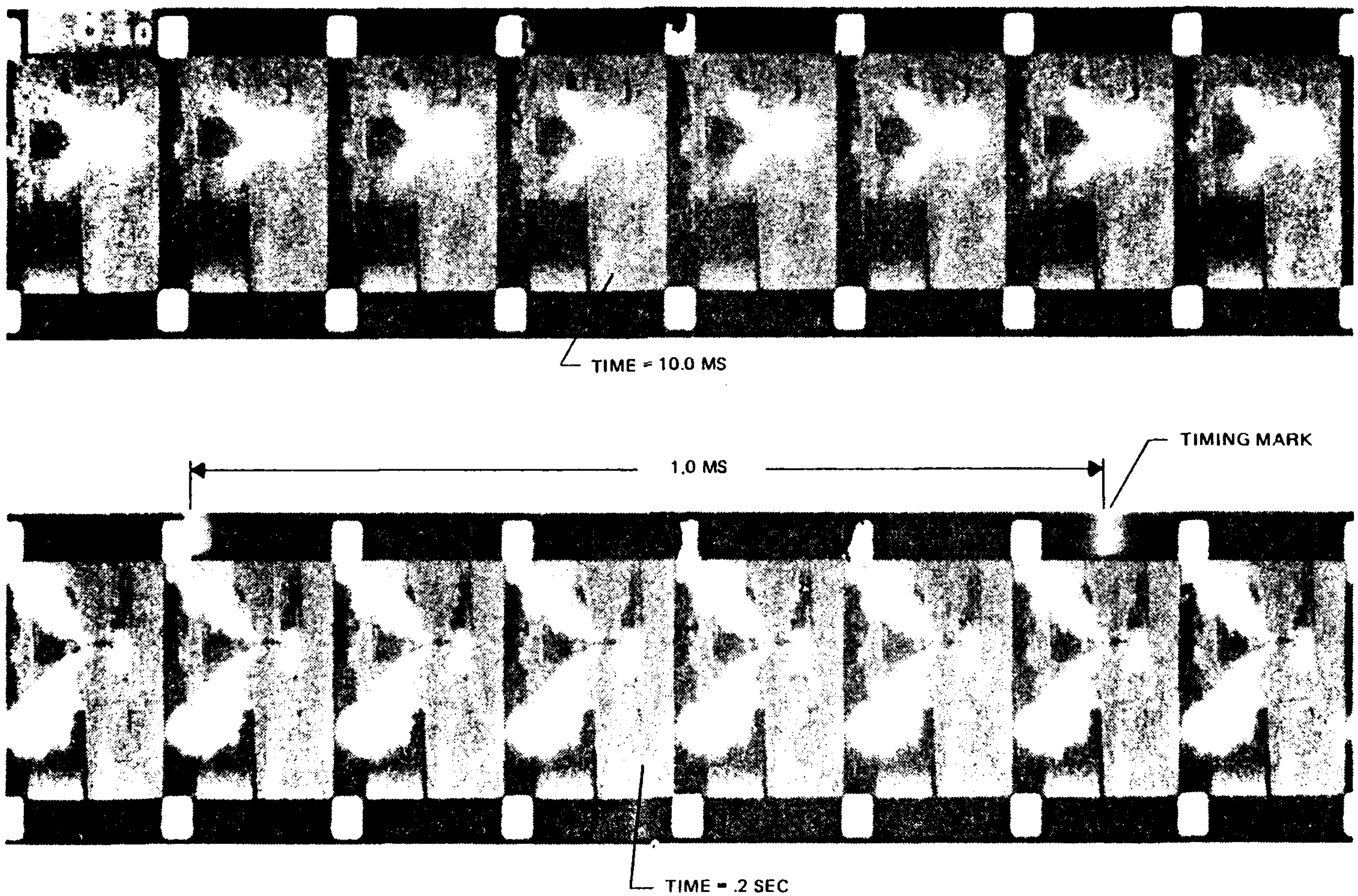


FIGURE 11A
16mm FILM CLIP MOD "E" TEST #51

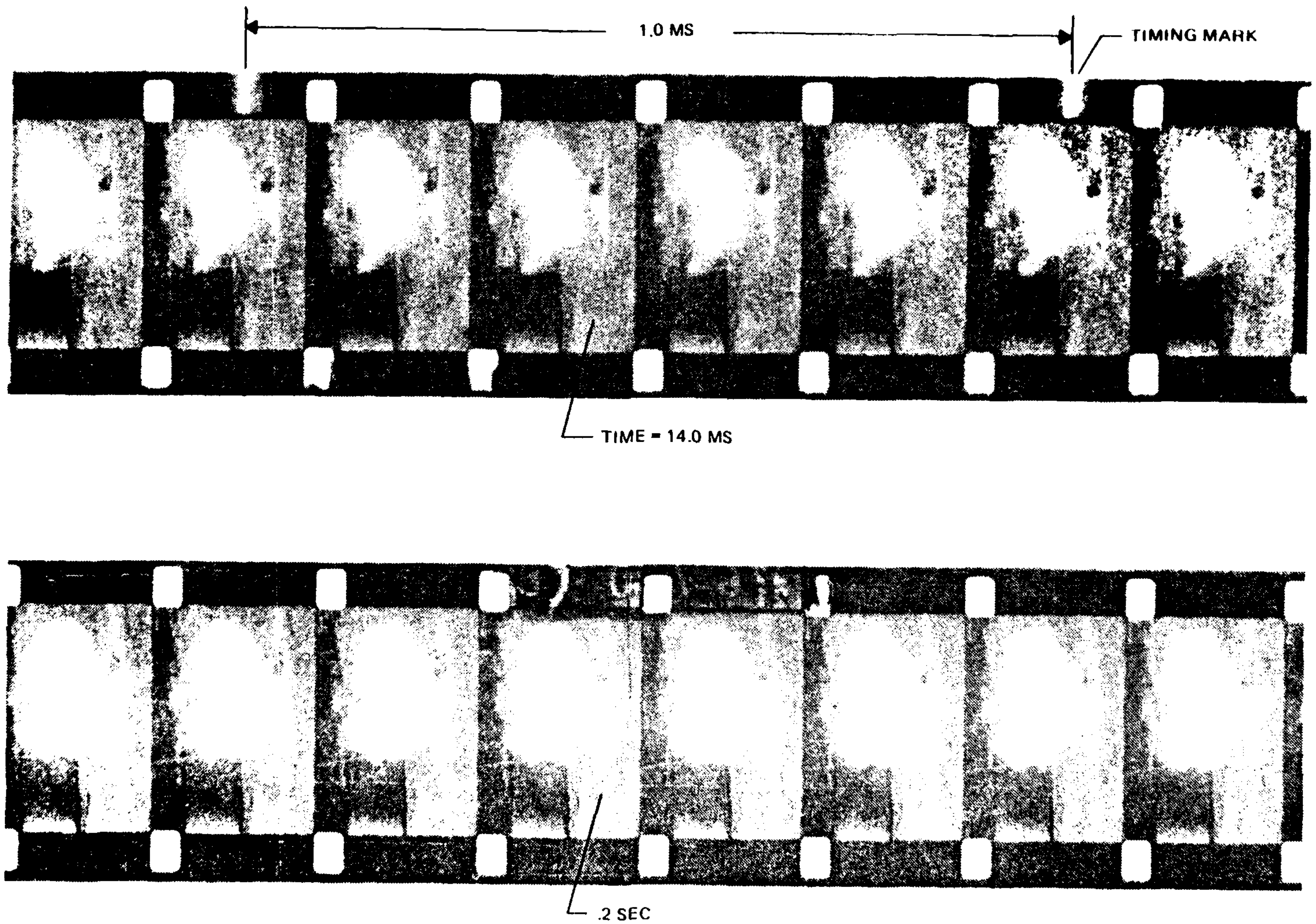


FIGURE 11B
16mm FILM CLIP ORI "C" TEST #48

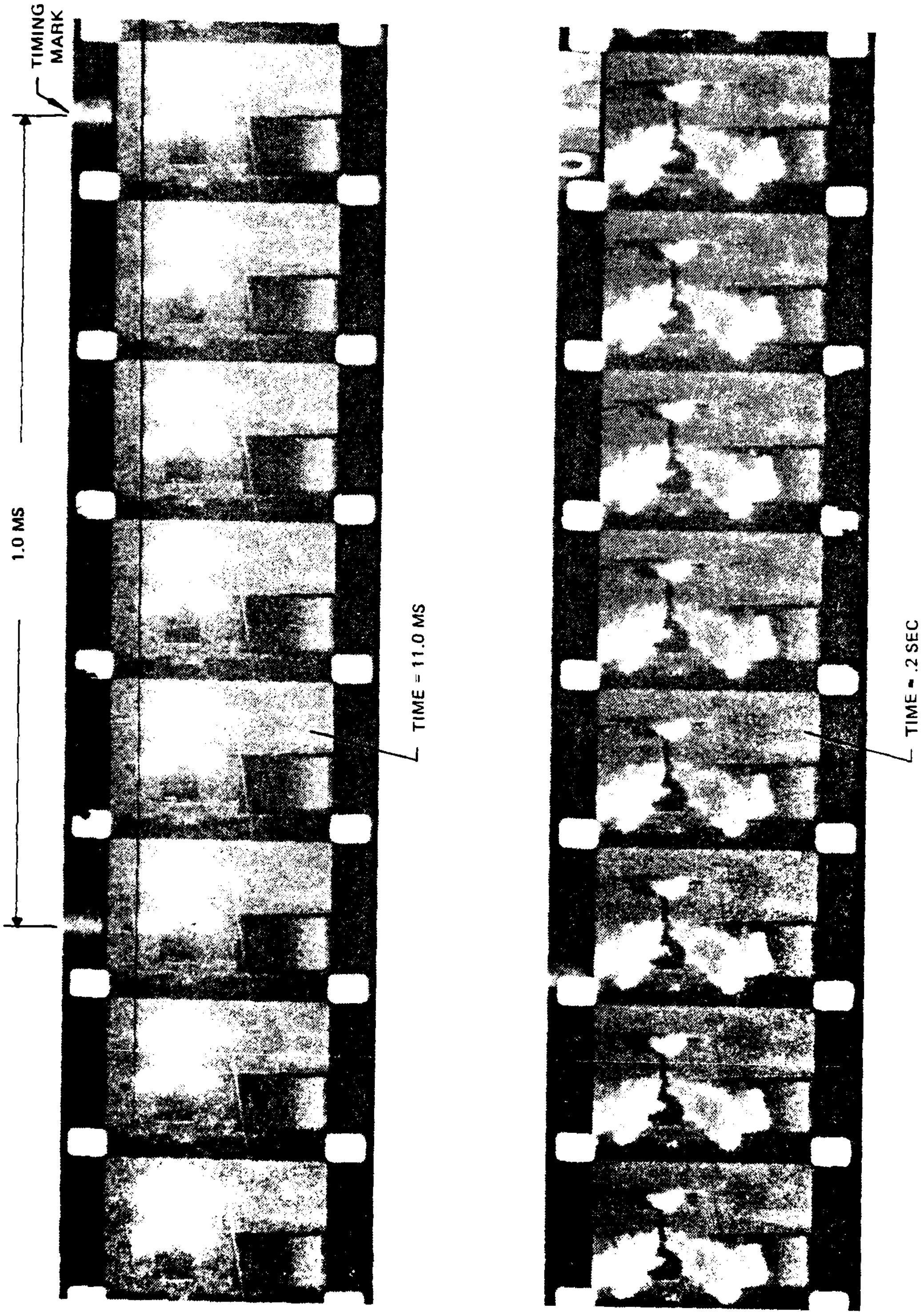


FIGURE 11C
16mm FILM CLIP MBA $TiCL_4$ TEST #53

Figure 12 presents ARRADCOM's estimate of the worst case, most rapid burial condition for the 155mm projectile in question. This condition exists in deeply saturated light sand soils. The ARRADCOM model predicts coverage of the smoke ports located 19 inches back on the projectile, 1.8 milliseconds after impact.

MBA has performed a similar, though less detailed, analysis using data from Lawrence Livermore Labs. which predicts a worst case burial time on the order of 2.2 milliseconds. One sigma error band on the MBA model is on the order of 0.5 milliseconds.

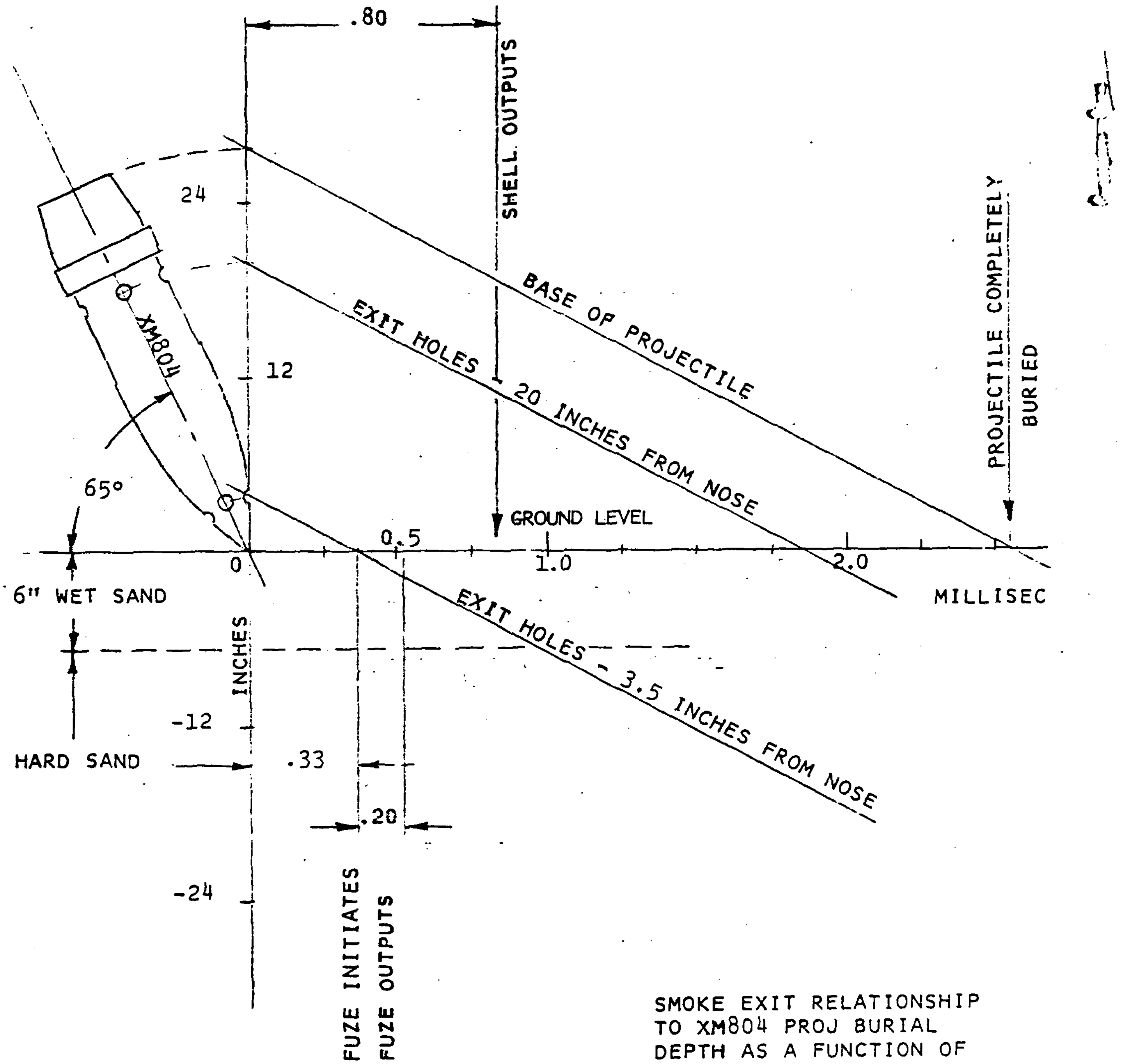
$$1.7 \text{ ms} \leqslant \text{Burial Time} \leqslant 2.7 \text{ ms}$$

There is probably a similar, though unknown to MBA, error band on the ARRADCOM model and in any event, the predictions from both models agree reasonably well. They both indicate that for worst case impact conditions, a design that produces significant quantities of smoke in approximately 1.7 to 1.8 milliseconds should be very effective when functioned on soft impact medias.

Unfortunately, this is not the case. The fastest mix, ARRADCOM MOD E, per Table 4, begins visible generation in approximately 2.0 ms and the MBA $TiCl_4$ configuration using the ARRADCOM MOD E mix as an expulsion charge plus flash and smoke enhancer has an equivalent time of approximately 2.5 ms. The ORC "C" configuration is very slow relative to the other two candidates with a smoke on-set time in the 6.0 millisecond range.

If the mathematical models are approximately correct, the ORC configuration will prove to be unacceptably slow. Hope can be held out for the other two configurations because their function times are within the error band. The ARRADCOM version has a function time very close to the ARRADCOM model mean time and faster than the equivalent MBA model time.

Explusion port geometry can further improve the probability of achieving a visible cloud on soft media impact. The ports can be canted back at 45 degrees. With the choked flow gases exiting at Mach 1 from the canted ports, the gases will have a net forward velocity component approximately 1/3 that of the shell at the critical period when they flow into the circular cavity between the shell and ejected from impact.



SMOKE EXIT RELATIONSHIP TO XM804 PROJ BURIAL DEPTH AS A FUNCTION OF EXIT HOLE LOCATION

IMP VEL - 900 FT/SEC
IMP ANGLE - 65 DEG
MEDIUM - WET SAND

FIGURE 12

L. POST
NOV. 79

The temperature testing (-30°F and +130°F) showed no real change in function time or cloud size compared to ambient temperature testing.

The $TiCl_4$ B configuration containers were used in Tests 52, 53 and 54 with no noticeable change in cloud size and function time.

Only a small number of tests were covered with the radiometer due to instrumentation problems.

The radiometer data sheet summary shows the peak intensity in each wavelength region, see Table 5. From the ratio of these intensities, an estimate of the maximum temperature (related to grey body temperature and atmospheric conditions) can be made.

The duration of time that the fuze was observed to burn, and the delay between initiating the fire control signal and the rise of fuze intensity was also recorded.

The measurement probes of the radiometers are spectrally filtered to separately measure intensity in the 1.7 - 2.8 micrometer range and the 3-5 micrometer range. Calibration was referenced to a Barnes Model 11-200T, 1060°C black body source for each set of measurements. See Figure 13.

Because of the low total power produced, the radiometers were moved as close as practical to the test fuze. The 7-1/2 degree field of view permitted measurements at 40 feet.

In its simplest form the radiometer equation is (1)

$$I = CVR^2$$

where

I = source intensity in w sr^{-1}

C = radiometer calibration in w SR^{-1} v^{-1} ft^{-2}

V = radiometer output voltage

R = source to radiometer distance in feet

The I/R^2 dependence of voltage on intensity is a result of the fact that the radiometer has no imaging optics and thus simply measures irradiance (watts per square meter at the detector).

TABLE 5

SMOKE TEST RESULTS FROM RADIOMETER

TEST	FUZE	DATE	I 1.7-2.8 Watts/Ster	I 3-5 Watts/Ster	TEMP °K	DURATION SEC	DELAY M.SEC± 1
#38	#076	9/20/79	477	1491	840	.225	-
#39		9/20/79	438	1316	850	.084	17.5
#40		9/20/79	876	2140	900	.2	11.2
#41		9/20/79	494	1438	860	.19 .15	15
#42		9/20/79	374	1456	800	.19 .10	18.8
	#048	9/13/79	2789	5380	960	.175	3.0
#11	#030	9/11/79	4662	11094	910	.25	-
		9/11/79	1499	2523	1020	.2	-
	#025	9/11/79	2288	4474	960	.225	-

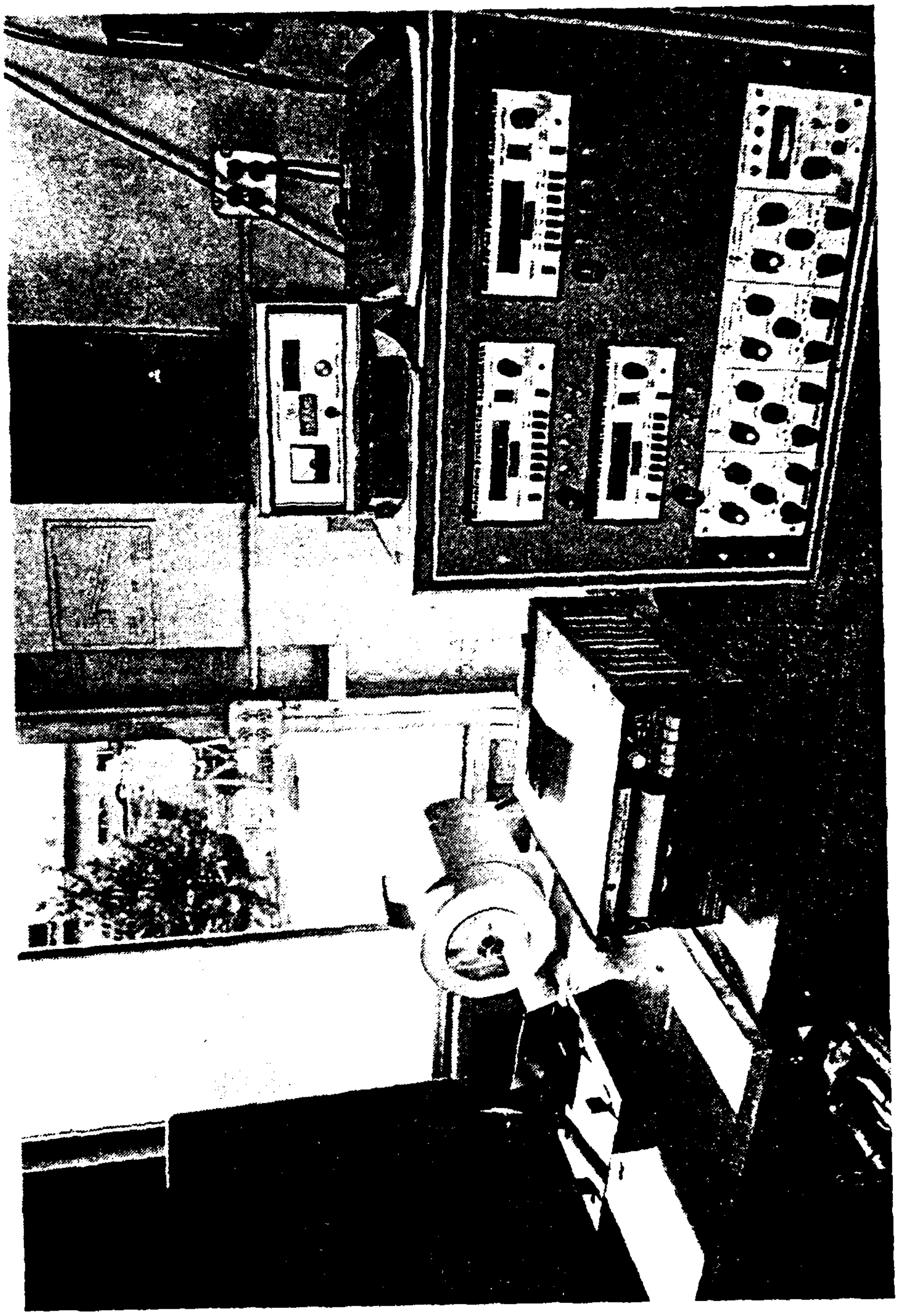


FIGURE 13
RADIOMETER BLACK SOURCE AND CONTROL

The radiometer response is a function of the wavelength of the incident radiation. This is because the atmosphere between the source and the radiometer; as well as the window, filter and detector, have wavelength dependent responses.

The equation which describes the radiometer voltage output for an irradiance of the radiometer by a monochromatic source of wavelength λ is

$$V(\lambda) = E \cdot sV_d(\lambda) \cdot T_a(\lambda) \cdot T_w(\lambda) \cdot T_f(\lambda)$$

where

E = the irradiance in $w\ m^{-2}$ in the plane of the detector in the absence of the radiometer or an atmosphere.

$sV_d(\lambda)$ = the spectral detector response in $vm^2\ w^{-1}$ for a given level of irradiance at wavelength λ. The term $V_d(\lambda)$ is a relative response of the system while s is a parameter that reflects the radiometer sensitivity. It may change with time or environment and thus makes periodic calibration necessary.

$T_a(\lambda)$, $T_w(\lambda)$, and $T_f(\lambda)$ = respectively the spectral transmittance of the atmosphere between the source and the radiometer, the radiometer window, and the radiometer filter.

Analysis for Ballistic Testing

The stress analysis on the critical components, i.e., the booster cup base and the cup/body interface, shows adequate margins of safety for safe operation (see Appendix A). In lieu of actual data on internal pressure required to separate or fail the cup base during detonation, an expected bursting pressure was calculated.

Factory of safety used in the margin of safety calculations were 1.15 applied to the yield allowable and 1.5 applied to the ultimate allowable. These values are standard aerospace practice. Because of the extremely high acceleration forces or set-back loads, the actual margins of safety during normal handling operations are far in excess of hazardous material requirements.

The methods, referenced in the analysis, are standard practice and should not cause concern over their validity. As demonstrated in the analysis, the minimum margin of safety occurred at the cup base material thickness transition from 0.040 inches to 0.104 inches. This margin is 0.80 on yield which represents a stress level 80 percent below the material allowable when reduced by the yield factor of safety. The most critical area is therefore approximately twice as strong as required to support the worse case loading.

The analysis also predicts a bursting pressure of 10,500 psi which appears to be compatible with good performance during the detonation event. Although actual pressures are not known, they are anticipated to be in the order of 20,000 psi if totally contained. This two to one pressure ratio is comfortable for good reliable failure expectation.

1.4 Plans for Next Period

Fabricate, assemble and deliver hardware to Ft. Lewis for test on or about November 6th, 42 each MOD E charges; 26 each ORIC charges; 8 each 747 Fuzes with MOD E and ORIC charges; 26 each 747 Fuzes without charges; 34 each 747 Fuzes with MBA charges; and 16 each 747 Fuzes with 6 each .437 dia. holes.

1.5 Expenditures

Expenditures for January through September, $77,500.

APPENDIX A

PRACTICE FUZE STRESS ANALYSIS

LOADING CONDITIONS

SURVIVE - SET-BACK FORCES

11,200 G'S

OPERATE - DETONATION

APPROACH

AARADCOM CONFIG TO BE CHECKED ONLY FOR SET-BACK FOR FAILURE OF THREADS AT CUP/BODY INTER-FACE & CUP BASE

MBA CONFIG TO BE SIZED TO SURVIVE SET-BACK & FAIL AT DETONATION.

CUP/BODY INTERFACE

CUP (TICL4 ;) - EST STRESS CONCENTRATION

EST DESIGN BASED ON SET-BACK

EVALUATE STRENGTH TO DETERMINE FAILURE MODES AT DETONATION.

WGT OF SMOKE CONTAINER 50 GRMS

MATERIAL ALLOWABLES

ASTM A-109 TEMPER 5

$F_{ty} = 44 \times 10^3$ PSI

OTHER PROPERTIES CAN BE EXPECTED TO BE

$F_{tu} = 67 \times 10^3$ PSI

$F_{su} = 44 \times 10^3$ PSI

REF ASME HANDBOOK, "METALS PROPERTIES," McGRAW-HILL, 1954

FACTORS OF SAFETY

USE STANDARD AEROSPACE VALUES

FS = 1.15 YIELD STRENGTH

FS = 1.50 ULTIMATE STRENGTH

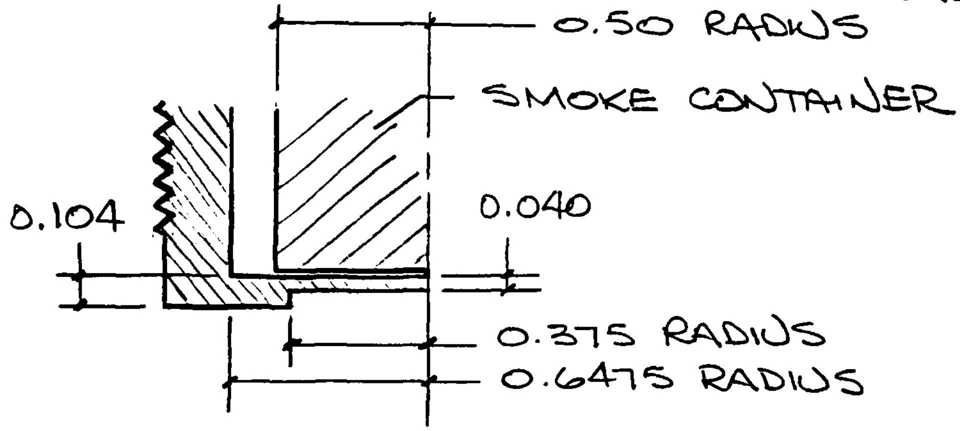
MARGIN OF SAFETY

DEFINITION: PERCENTAGE THAT MATERIAL ALLOWABLE EXCEEDS THE WORKING STRESS TIMES THE FACTOR OF SAFETY

$$MS = \frac{F_t}{FS \times f_t} - 1$$

$MS > 0$ FOR ADEQUATE STRUCTURE

AARADCOM CONFIGURATION - BOOSTER & CUP BASE



SMOKE CONTAINER (MOD E)

$W = 50/453.8 = 0.110 \text{ LB}$

$\ddot{X} = 11{,}200 \text{ G'S}$

$F = (0.110)(11{,}200) = 1234 \text{ LB}$

SOLVE FOR STRESS AT EDGE USING ROARK 4TH ED p 218 CASE 8 EDGES FIXED UNIFORM LOAD OVER CONCENTRIC CIRCLE r_0

RADIAL STRESS

$$f_r = \frac{3W}{2\pi t^2}\left[1 - \frac{r_0^2}{a^2}\right] \qquad a = 0.6475 \quad r_0 = 0.50$$

$$f_r = \frac{3(1234)}{2\pi(.104)^2}\left[1 - \left(\frac{.5}{.6475}\right)^2\right]$$

$f_r = 22000 \text{ PSI}$

TANGENTIAL STRESS

$$f_t = \frac{3W}{2\pi m t^2}\left[1 - \frac{r_o^2}{a^2}\right]$$

$$m = 1/\mu = 1/.3$$

$$\therefore \; f_t = .3\, f_r = 6600 \text{ PSI}$$

DETERMINE MAXIMUM OCTAHEDRAL STRESS

SEE "ANALYSIS AND DESIGN OF FLIGHT VEHICLE STRUCTURES," EF BRUHN, 1965, CHAPTER C1 p C.17 FOR OCTAHEDRAL SHEAR STRESS THEORY.

$$f_{max} = \sqrt{f_r^2 + f_t^2 - f_r f_t}$$

$$f_{max} = \sqrt{(22)^2 + (6.6)^2 - (22)(6.6)}\; 10^3$$

$$= 19{,}500 \text{ PSI}$$

MARGINS OF SAFETY

$$MS = \frac{F_t}{FS \times f_t} - 1$$

YIELD

$$MS = \frac{44 \times 10^3}{1.15(19.5 \times 10^3)} - 1 = \underline{\underline{0.96}}$$

ULTIMATE

$$MS = \frac{67 \times 10^3}{1.5(19.5 \times 10^3)} - 1 = \underline{\underline{1.29}}$$

SOLVE FOR STRESS AT R = 0.5 (EDGE OF 0.040 THK DISC)

THE CUP BASE IS A REDUNDANT STRUCTURE & THE LOAD WILL DISTRIBUTE ON TO THE TWO BASE THICKNESS SUCH THAT THEIR INTERFACE WILL HAVE THE SAME DEFLECTION. THE DISTRIBUTION WILL BE INVERSELY PROPORTIONAL TO THEIR DEFLECTION. ASSUME THE PLATE STIFFNESS RATIO IS PROPORTIONAL TO t^3 AS FOR A BEAM IN BENDING THEN THE LOAD ON THE CENTER WILL BE

$$W_c = \frac{(0.04)^3}{(.104)^3 + (.04)^3} W$$

$$= 66 \text{ LB} \quad .054$$

AGAIN FROM ROARK CASE 8 AT $r = 0.5$

$$f_r = \frac{3W}{2\pi m t^2}\left[(m+1)\log\frac{a}{r_0} + (m+1)\frac{r_0^2}{4a^2} - (3m+1)\frac{r^2}{4r_0^2}\right]$$

$$(m+1)\log\frac{a}{r_0} = \left(1+\frac{1}{.3}\right)\log\frac{.6475}{.5} = 0.486 \ ?$$

$$(m+1)\frac{r_0^2}{4a^2} = \left(1+\frac{1}{.3}\right)\left(\frac{.5}{1.295}\right)^2 = 0.646$$

$$(3m+1)\frac{r^2}{4r_0^2} = \left(1+\frac{3}{.3}\right)\left(\frac{.375}{1.0}\right)^2 = 1.547$$

$$f_r = \frac{3(66)3}{2\pi(.04)^2}\left[.486 + .646 - 1.547\right]$$

$$= -24\,500 \text{ PSI}$$

(– SIGN DENOTES TENSION ON TOP SURFACE)

$$f_t = -\frac{3W}{2\pi m t^2}\left[(m+1)\log\frac{a}{r_0} + (m+1)\frac{r_0^2}{4a^2} - (m+3)\frac{r^2}{4r_0^2}\right]$$

$$(m+3)\frac{r^2}{4r_0^2} = \left(\frac{1}{.3}+3\right)\left(\frac{.375}{1.0}\right)^2 = 0.890$$

$$f_t = -\frac{3(66)3}{2\pi(.04)^2}\left[.486 + .646 - .890\right]$$

$$= -14{,}300 \text{ PSI}$$

MAXIMUM STRESS AT $r = 0.375$

$$f_{max} = \sqrt{(24.5)^2 + (14.3)^2 - (24.5)(14.3)} \times 10^3$$

$$= 21{,}300 \text{ PSI}$$

MARGINS OF SAFETY

YIELD

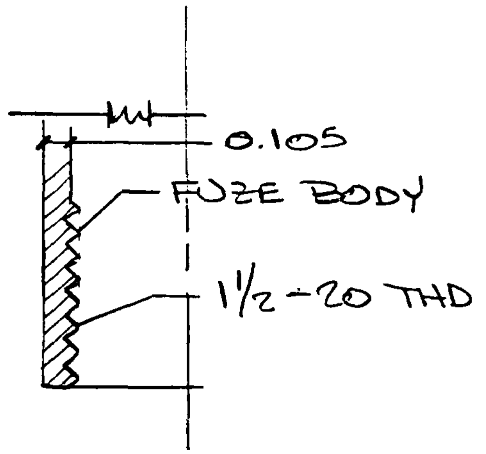
$$MS = \frac{44 \times 10^3}{(1.15)(21.3)10^3} - 1 = \underline{\underline{0.796}}$$

ULTIMATE

$$MS = \frac{67 \times 10^3}{(1.5)(21.3)10^3} - 1 = \underline{\underline{1.097}}$$

THE MBA CONFIGURATION IS IDENTICAL TO MOD E FOR CUP BASE LOADING ∴ THE MOD E STRESS ANALYSIS APPLIES.

MBA CONFIGURATION - THREAD SHEAR



MATERIAL PROPERTIES

2024-T4 AL ALLOY

$F_{tu} = 62 \times 10^{3}$ PSI

$F_{ty} = 42 \times 10^{3}$ PSI

$F_{su} = 37 \times 10^{-3}$ PSI

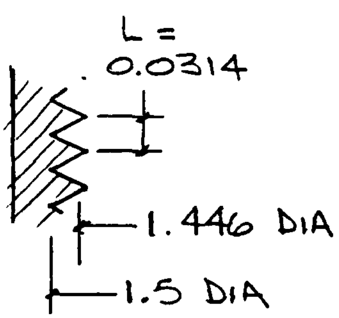
THE ALUMINUM BODY WILL BE CRITICAL BECAUSE THE ALUMINUM ALLOWABLES ARE SLIGHTLY LOWER ~~THE~~ ~~THE~~ A-109 STEEL VALUES

THE LOAD ON THE MBA CONFIGURATION IS ≃ 3 TIMES THAT ON THE MOD E FUZE ∴ ONLY THE MBA CONFIGURATION WILL BE ANALYZED

$$WGT(TICL4) = 0.565 \text{ LB}$$

$$WGT(WP + SMOKE) = 0.220 \text{ LB}$$

$$F = (.565 + .220)\,11{,}200 = 8800 \text{ LB}$$



AREA IN SHEAR

$$A = \pi D L N$$

$$= \pi(1.446)(0.0314)(17.5)$$

$$= 2.5 \text{ IN}^2$$

$$f_s = \frac{P}{A} = \frac{8800}{2.5} = 3520 \text{ PSI}$$

$$MS = \text{HIGH}$$

CHECK BODY TENSION

$$A = \pi D_M t$$

$$= \pi(1.6)(.105) = 0.528 \text{ IN}^2$$

$$f_t = \frac{P}{A} = \frac{8800}{.528} = 16{,}700 \text{ PSI}$$

YIELD..

$$MS = \frac{42 \times 10^3}{1.15(16.7)10^3} - 1 = \underline{1.18}$$

ULTIMATE

$$MS = \frac{62 \times 10^3}{1.5(16.7)10^3} - 1 = \underline{\underline{1.47}}$$

EVALUATION OF RUPTURE PRESSURE

THE PRESSURE REQUIRED TO RUPTURE THE CUP BASE CAN BE ESTIMATED BY DETERMINING THE FORCE REQUIRED TO FAIL THE BASE & THE TRANSLATING THIS FORCE INTO A PRESSURE

THE MINIMUM MARGINS OF SAFETY OCCUR AT THE CHANGE IN BASE THICKNESS, WHERE

$$f_r = \frac{3W}{2\pi m t^2}\left[(m+1)\log\frac{a}{r_0} + (m+1)\frac{r_0^2}{4a^2} - (3m+1)\frac{r^2}{4r_0^2}\right]$$

$$f_t = \frac{3W}{2\pi m t^2}\left[(m+1)\log\frac{a}{r_0} + (m+1)\frac{r_0^2}{4a^2} - (m+3)\frac{r^2}{4r_0^2}\right]$$

BECAUSE ONLY W IS A VARIABLE THE RATIO f_r/f_t WILL BE A CONSTANT

EQUATION f_{max} TO THE ULTIMATE ALLOWABLE

$$F_u = f_{max} = \sqrt{f_r^2 + f_t^2 - f_r f_t}$$

$$f_r/f_t = \frac{24.5}{14.3} = 1.713$$

$$F_u = \sqrt{(1.713)^2 + 1 - 1.713}\ f_t$$

$$= 1.5 f_t \qquad f_t = \frac{67\times10^3}{1.5} = 44{,}700 \text{ PSI}$$

$$44{,}700 = \frac{3W3}{2\pi(.04)^2}\left[.486 + .646 - .890\right]$$

$$W = 206.3 \text{ LB}$$

AREA OF PRESSURE ACTION

$$A = \frac{\pi}{4}(.375)^2 = 0.1104 \text{ IN}^2$$

PRESSURE $= 206.3/.11$

$= 1870$ PSI

THIS PRESSURE APPEARS TO BE ON THE LOW SIDE A BETTER APPROACH MAY BE TO USE ROARK CASE 6, EDGES FIXED, UNIFORM LOAD OVER ENTIRE SURFACE.

$$f_r = \frac{3W}{4\pi t^2} \qquad f_t = \frac{3W}{4\pi m t^2}$$

$$\therefore \frac{f_t}{f_r} = .3 =$$

$$f_m = \sqrt{(.3)^2 + 1 - .3}\; f_t = 0.90 f_t$$

$$f_t = \frac{67 \times 10^3}{0.9} = 75\,400 \text{ PSI}$$

$$75\,400 = \frac{3W3}{4\pi(.105)^2} = 65W$$

$$W = 1160$$

$$\text{PRESSURE} = \frac{1160}{.1104} = 10{,}507 \text{ PSI}$$

WHICH APPEARS TO BE A MORE MEANINGFUL VALUE.

ATTACHMENT A

SMOKE COMP. (PROJ. 069) P/N SW-522 B/N 082979-1

START 1:30	STOP 3:30
TEMP.	HUMIDITY

W/O #4780

EN TEMP.	TIME: IN	TIME: OUT	[redacted]	DESSICANT	
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM NITRATE		
130°F	2:30PM (8/27)	8:00AM (8/28)	ZINC DUST		
130°F	2:30PM (8/27)	8:00AM (8/28)	ALUM. POWDER		

COMMENTS: Comp. blended in Ball Jar on Ball Mill. Using (50 ea.) 00 RUBBER STOPPERS.

Comp. consists of.

		Percent by wt.
ZINC DUST	181.45 GRAMS	40%
ALUM. POWDER	90.7 GRAMS	20%
POTASSIUM PERCHLORATE	90.7 GRAMS	20%
POTASSIUM NITRATE	90.7 GRAMS	20%

ALUM. POWDER
MIL-P-14067A
TYPE II 200/325
VALIMET
P.O.# 69929

POTASSIUM PERCHLORATE
MIL-P-217A
GR.A CL.4
BARIUM & CHEMICALS
P.O.# 69931

POTASSIUM NITRATE
MIL-P-156B
CL. 2
Croton Chemicals
P.O.# 69930

ZINC DUST
JAN-Z-365
Picatinny Arsenal
Chas. Knapp 201-328-3052

8/30/79

083079-1

Smoke Comp. (PROJ. 069) P/N SW-522 B/N ~~[illegible]~~

START 8:20	STOP 10:20
TEMP.	HUMIDITY

W/O # 4780 L/N-1

OVEN TEMP.	TIME: IN	TIME: OUT	~~[illegible]~~	DESSICANT	
140 °F	10:30AM(8/28)	8:30 AM (8/29)	POTASSIUM PERCHLORATE		
140 °F	10:30 A.M (8/28)	8:30 A.M (8/29)	POTASSIUM NITRATE		
130 °F	2:30PM (8/27)	8:00 AM (8/28)	ZINC DUST		
130 °F	2:30PM (8/27)	8:00 A.M (8/28)	ALUM. POWDER		

COMMENTS: Comp. blended in Ball jar on Ball Mill. Using (50 ea) 00 Rubber Stoppers.

Comp. consists of. percent by wt.

Zinc Dust - 181.45 GRAMS - 40 %

Alum. Powder - 90.7 GRAMS - 20 %

Potassium perchlorate - 90.7 G - 20 %

Potassium Nitrate - 90.7 GRAMS 20 %

ALUM. POWDER
MIL-P-140674 A
TYPE II 200/325
VALIMET
P.O. # 69929

POTASSIUM PERCHLORATE
MIL-P-217 A
GR. A CL. 4
BARIUM + CHEMICALS
P.O. # 69931

POTASSIUM NITRATE
MIL-P-156 B
CL. 2
CROTON CHEMECALS
P.O. # 69930

ZINC DUST
JAN-Z-365
PICATINNEY ARSONAL
CHAS. KNAPP 201-328-3057

SMOKE COMP. P/N SW-522

B/N C83079-2 L/N-1 PROJECT 069

START 11:00 AM	STOP 1:00 PM
TEMP.	HUMIDITY

W/O # 4780

OVEN TEMP.	TIME: IN	TIME: OUT	MAT'L DRIED ~~SCREEN SIZE~~	DESSICANT	
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM NITRATE		
130°F	2:30PM (8/27)	8:00AM (8/28)	ZINC DUST		
130°F	2:30PM (8/27)	8:00AM (8/28)	AL. POWDER		

COMMENTS: Comp. blended in Ball Jar on Ball Mill, using 00 Rubber stoppers (50ea.).

Comp. consists of; Percentage by wt.

ZINC DUST	40%	204.15 G.
ALUMINUM POWDER	20%	102.0 G.
POTASSIUM PERCHLORATE	20%	102.0 G.
POTASSIUM NITRATE	20%	102.0 G.

(ALUMINUM POWDER
MIL-P-14067A
TYPE II 20/325
VALIMET
P.O.# 69929)

(POTASSIUM PERCHLORATE
MIL-P-217A
GR. A CL. 4
BARIUM & CHEMICALS
P.O.# 69931)

(POTASSIUM NITRATE
MIL-P-156B
CL. 2
CROTON CHEMICALS
P.O. # 69930)

(ZINC DUST
JAN-Z-365
PICATINNY ARSONAL
CHAS. KNAPP - 201-328-3052)

DATE 8/30	COMP. SMOKE COMP. P/N SW-522	AMOUNT 453.6

B/N 083079-3 S/N-1 PROJ. 069

START 1:30 PM	STOP 3:30 PM
TEMP.	HUMIDITY 40%

W/O #4780

OVEN TEMP.	TIME: IN	TIME: OUT	MAT'L DRIED ~~SCREEN SIZE~~	DESSICANT	
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM NITRATE		
130°F	2:30 PM (8/27)	8:00AM (8/28)	ZINC DUST		
130°F	2:30 PM (8/27)	8:00AM (8/28)	AL. POWDER		

COMMENTS: Comp. blended in Ball Jar ~~on~~ Ball Mill, using 00 RUBBER STOPPERS (50 ea.).

Comp. Consists of; Percentage by wt.

ZINC DUST - 181.45 GRAMS - 40%

ALUM. POWDER - 90.7 GRAMS - 20%

POTASSIUM PERCHLORATE - 90.7 GRAMS - 20%

POTASSIUM NITRATE - 90.7 GRAMS - 20%

ALUM. POWDER
MIL-P-14067A
TYPE II . 20/325
VALIMET
P.O. # 69929

POTASSIUM PERCHLORATE
MIL-P-217A
GR.A - CL.4
BARIUM & CHEMICALS
P.O. # 69931

POTASSIUM NITRAT
MIL-P-156B
CL.2
CROTON CHEMICAL
P.O. # 69930

ZINC DUST
JAN-Z-365
CHAS. KNAPP

B/N 083179-1 W/O # 4780 L/N 1 PROD. 069

START 9:00	STOP 11:00
TEMP.	HUMIDITY

EN TEMP.	TIME: IN	TIME: OUT	MAT'L DRIED ~~SCREEN SIZE~~	DESSICANT	
140°F	10:30AM (8/28)	8:30Am (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM NITRATE		
130°F	2:30PM (8/27)	8:00AM (8/28)	ZINC DUST		
130°F	2:30PM (8/27)	8:00AM (8/28)	ALUMINUM POWDER		

COMMENTS: COMP. BLENDED IN BALL JAR ON BALL MILL, USING 00 RUBBER STOPPERS.

COMP. CONSISTS OF; PERCENTAGE BY WT.

ZINC DUST – 181.45 GRAMS – 40%

ALUMINUM POWDER – 90.7 GRAMS – 20%

POTASSIUM PERCHLORATE – 90.7 GRAMS – 20%

POTASSIUM NITRATE – 90.7 GRAMS – 20%

ALUMINUM POWDER
MIL-P-14067A
TYPE II 200/325
VALIMET
P.O.# 69929

POTASSIUM PERCHLORATE
MIL-P-217A
GR. A CL. 4
BARIUM & CHEMICALS
P.O. # 69931

POTASSIUM NITRATE
MIL-P-156B
CL. 2
CROTON CHEMICALS
P.O. # 69930

ZINC DUST
JAN-Z-365
PICATINNY ARSONAL
CHAS. KNAPP
201-328-3052

SIGNAL COMP. MIL-SW-522 [illegible] 453-6

B/N 083179-2 W/O # 4780 2/N1 PROJ. 069

START 11:45 STOP 1:45

TEMP. HUMIDITY

OVEN TEMP.	TIME: IN	TIME: OUT	MAT'L. DRIED	DESSICANT	
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM NITRATE		
130°F	2:30PM (8/27)	8:00AM (8/28)	ZINC DUST		
130°F	2:30PM (8/27)	8:00AM (8/28)	ALUMINUM POWDER		

COMMENTS: COMP. BLENDED IN BALL JAR ON BALL MILL, USING 00 RUBBER STOPPERS (50ea.).

COMP. CONSISTS OF; PERCENTAGE BY WT.

ZINC DUST — 181.45 G. — 40%
ALUM. POWDER — 90.7 G. — 20%
POTASSIUM PERCHLORATE — 90.7 G. — 20%
POTASSIUM NITRATE — 90.7 G. — 20%

ALUMINUM POWDER
MIL-P-14067A
TYPE II 200/325
VALIMET
P.O. # 69929

POTASSIUM PERCHLORATE
MIL-P-217A
GR. A CL. 4
BARIUM & CHEM.
P.O. # 69931

POTASSIUM NITRATE
MIL-P-156B
CL. 2
CROTON CHEM.
P.O. # 69930

ZINC DUST
JAN-Z-365
PICATINNY ARSONAL
CHAS. KNAPP
201-328-3052

SMOKE COMP. P/N SW-322 AMOUNT 453.6 G

B/N 083179-3 L/N-1 W/O #4780 PROJ. 069

START 1:45	STOP 3:45
TEMP.	HUMIDITY

OVEN TEMP.	TIME: IN	TIME: OUT	MAT'L DRIED	DESSICANT	
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30AM (8/28)	8:30AM (8/29)	POTASSIUM NITRATE		
130°F	2:30PM (8/27)	8:00AM (8/28)	ZINC DUST		
130°F	2:30PM (8/27)	8:00AM (8/28)	ALUM. POWDER		

COMMENTS: COMP. BLENDED ON BALL MILL ON BALL JAR, USING 00 RUBBER STOPPERS (50 ea.).

COMP. CONSISTS OF; PERCENTAGE BY WT.

ZINC DUST - 181.45 G. - 40%
AL. POWDER - 90.7 G. - 20%
POTASSIUM PERCHLORATE - 90.7 G. - 20%
POTASSIUM NITRATE - 90.7 G. - 20%

ALUM. POWDER
MIL-P-14067A
TYPE II 20/325
VALIMET
P.O. #69929

POTASSIUM PERCHLORATE
MIL-P-217A
GR. A CL. 4
BARIUM & CHEM.
P.O. # 69931

POTASSIUM NITRATE
MIL-P-156B
CL. 2
CROTON CHEM.
P.O. # 69930

ZINC DUST
JAN-Z-365
..CATINNY ARSONAL
CHAS. KNAPP
201-328-3052

AMOUNT 453.6 G

P/N SW-522 B/N 092479-1 4N1

START 9:30 AM	STOP 11:30 PM
TEMP.	HUMIDITY

W/O # 4780

OVEN TEMP.	TIME: IN	TIME: OUT	~~SCREEN SIZE~~	DESSICANT	
140°F	10:30 AM (8/28)	8:30 Am (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30 AM (8/28)	8:30 Am (8/29)	POTASSIUM NITRATE		
140°F	DRIED 24 HRS.		ZINC DUST		
130°F	2:30 PM (8/27)	8:00 Am (8/29)	ALUMINUM POWDER		

COMMENTS: Comp blended in Ball Jar on Ball Mill, using OO RUBBER STOPPERS (50 EA.).

Comp. Consists of; Percentage by wt.

ZINC DUST - 181.45 GRAMS —— 40%

ALUMINUM POWDER - 90.7 GRAMS —— 20%

POTASSIUM PERCHLORATE - 90.7 GRAMS — 20%

POTASSIUM NITRATE - 90.7 GRAMS — 20%

ALUM. POWDER
MIL-P-14067A
TYPE II 20/325
VALIMET
P.O. # 69929

POTASSIUM PERCHLORATE
MIL-P-217A
GR.A CL.4
BARIUM & CHEMICALS
P.O. # 69931

POTASSIUM NITRATE
MIL-P-156B
CL.2
CROTON CHEMICALS
P.O. # 69930

ZINC DUST
NJ ZINC CO.
SFD 122

SILICKE COMP. (PROJ. 069) P/N SW-522 B/N 092479-2 4/N

START 1:00	STOP 3:00
TEMP.	HUMIDITY

W/O # 4780

OVEN TEMP.	TIME: IN	TIME: OUT	~~SCREEN SIZE~~	DESSICANT	
140°F	10:30 AM (8/28)	8:30 AM (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30 AM (8/28)	8:30 AM (8/29)	POTASSIUM NITRATE		
140°F	CURED 24 HRS		ZINC DUST		
130°F	2:30 PM (8/27)	8:00 AM (8/28)	ALUMINUM POWDER		

COMMENTS: Comp. blended in Ball Jar on Ball Mill, using OO rubber stoppers (50 ea.).

Comp. Consists of; — Percentage by wt.

ZINC DUST - 181.45 GRAMS — 40%

ALUMINUM POWDER - 90.7 G. — 20%

POTASSIUM PERCHLORATE - 90.7 G. — 20%

POTASSIUM NITRATE - 90.7 G. — 20%

ALUM. POWDER
MIL-P-14067A
TYPE II 20/325
VALIMET
P.O. # 69929

POTASSIUM PERCHLORATE
MIL-P-217A
GR. A - CL. 4
BARIUM CHEMICALS
P.O. # 69931

POTASSIUM NITRATE
MIL-P-156B
CL. 2
CROTON CHEMICALS
P.O. # 69930

ZINC DUST
N.J. ZINC CO.
SFD 122

AMOUNT [illegible] G.

SMOKE COMP. (PROJ. 069) P/N SW-522 B/N 092579-1 4/N 1

START 11:00	STOP
TEMP.	HUMIDITY

W/O # 4780

[OV]EN [OV]N TEMP.	TIME: IN	TIME: OUT	~~SCREEN SIZE~~	DESSICANT	
140°F	10:30 AM (8/28)	8:30 AM (8/29)	POTASSIUM PERCHLORATE		
140°F	10:30 AM (8/28)	8:30 AM (8/29)	POTASSIUM NITRATE		
140°F	CURED 24 HRS.		ZINC DUST		
130°F	2:30 PM (8/27)	8:00 AM (8/28)	ALUMINUM POWDER		

COMMENTS: Comp. blended in Ball Jar on Ball Mill, using 00 rubber stoppers (50 ea.).

Comp. consists of: Percentage by wt.

ZINC DUST - 181.45 GRAMS ———— 40%

ALUMINUM POWDER - 90.7 GRAMS ———— 20%

POTASSIUM PERCHLORATE - 90.7 GRAMS ———— 20%

POTASSIUM NITRATE - 90.7 GRAMS ———— 20%

AL. POWDER
MIL-P-14067A
TYPE II 200/325
VALIMET
P.O. # 69929

POTASSIUM PERCHLORATE
MIL-P-217A
GR.A - CL.4
BARIUM CHEM.
P.O. # 69931

POTASSIUM NITRATE
MIL-P-156B
CL.2
CROTON CHEM.
P.O. # 69930

ZINC DUST
N.J. ZINC CO.
SFD-122

ATTACHMENT B

[illegible]/79

SMOKE CONTAINERS / DET [redacted] CORD

#1. GROSS 303.65 GRAMS (S/N [illegible])
TARE 258.65 "
NET 45.0 "

#2. GROSS 304.6 GRAMS (S/N [illegible])
TARE 258.65 "
NET 45.95 "

#3. GROSS 303.6 GRAMS (S/N 0[illegible])
TARE 258.65 "
NET 44.95 "

#4. GROSS 303.45 GRAMS (S/N 0[illegible])
TARE 258.6 "
NET 44.85 "

#5. GROSS 302.3 GRAMS
TARE 258.6 "
NET 43.7 "

WT. OF [redacted] DET CORD = 1.51 GRAMS TOTAL WT
= .875 GRAINS EXPLOSIVE WT.

SMOKE COMP. B/N 082979-1 L/N 1

1/10/79

SMOKE CONTAINERS / DET. CORD

SMOKE COMP. – B/N 082979-1 L/N 1

S/N 6. GROSS – 250.60G.
TOT. TARE – 205.55 G.
NET – 45.05 G.

BASE TARE – 198.1 G.
CONTAINER TARE
WITH LID 7.45G.
205.55

S/N 7. GROSS – 251.2 G.
TOT. TARE – 205.5 G.
NET – 45.7 G.

BASE TARE – 198.1G.
CONTAINER TARE
WITH LID – 7.4 G.
205.5

S/N 8. GROSS – 251.05 G.
TOT. TARE – 205.50 G.
NET – 45.55 G.

BASE TARE – 198.1G.
CONTAINER TARE
WITH LID – 7.4 G.
TOT. TARE – 205.5 G.

S/N 9. GROSS – 250.60G
TOT. TARE – 205.55G.
45.05G.

BASE TARE – 198.1 G.
CONTAINER TARE
WITH LID – 7.45G.
205.55G.

S/N 10. GROSS – 250.50
TOT. TARE – 205.55 G.
NET – 44.95G.

BASE TARE – 198.1G.
CONTAINER TARE – 7.45G.
WITH CAP
TOT. TARE WT – 205.55

S/N 9 Filled container ≈ half full with B/N 082979-1 and used B/N 083079-1 to fill smoke container.

1/10/79 SMOKE CONTAINERS

SMOKE COMP. – B/N 083079-1 – 4/N1 – NO DET. CORD

S/N 11 – GROSS – 50.01 G.
CONTAINER/LID TARE – 5.90 G.
NET – 44.11 G.

S/N 12 GROSS – ~~49.65~~ G. 50.45
CONTAINER/LID TARE – ~~5.90~~ G. 5.90
NET – ~~43.75~~ G. 44.55

S/N 13 GROSS – ~~52.70~~ 51.02
CONTAINER/LID TARE – ~~5.90~~ 5.90
NET – ~~46.85~~ 45.12

S/N 14 GROSS – 52.70
CONTAINER/LID TARE – 5.85
NET – 46.85

:/10/79 SMOKE CONTAINERS / DET. CORD 069

SMOKE COMP. B/N 083079-1 L/N 1

S/N 15 GROSS - 54.4 G.
CONTAINER/LID TARE - 7.45 G.
NET 46.95 G.

S/N 16 GROSS - 54.6 G.
CONTAINER/LID TARE - 7.45 G.
NET 47.15 G.

S/N 17 GROSS - 53.9 G
CONTAINER/LID TARE - 7.6 G
NET - 46.3 G

S/N 18 GROSS - 54.2 G
CONTAINER/LID TARE 7.6
NET 46.6 G

S/N 19 GROSS - 52.6 G NO DET. CORD
CONTAINER/LID TARE 6.0 G
NET 46.6 G

SMOK COMP. B/N 083079-2
S/N 20 GROSS - 52.5 G NO DET. CORD
CONTAINER/LID TARE 6 0 G
NET 46.5 G

S/N 21 GROSS - 54.9 G NO DET. CORD
LID/CONTAINER TARE - 5.9 G.
NET - 49.0 G

S/N 22 GROSS - 53.45 G. NO DET. CORD
CONTAINER/LID TARE - 5.9 G.
NET 47.55 G.

7/11/.. — SMOKE CONTAINERS

B/N 083079-2

S/N 23 GROSS — 52.75 G. NO DET. CORD
CONTAINER/LID TARE — 5.9 G.
NET — 46.85 G.

S/N 24 GROSS — 52.8 G NO DET. CORD
CONTAINER/LID TARE — 5.9 G.
NET — 46.9 G.

S/N 25 GROSS — 54.25 G.
CONTAINER/LID TARE — 7.35 G.
WITH DET CORD NET — 47.50 G.

S/N 26 GROSS — 54.5 G.
CONTAINER/LID TARE — 7.35 G.
WITH DET. CORD NET — 47.15 G.

S/N 27 GROSS — ~~51.7~~ G. 53.3 G.
TARE ~~5.85~~ G. 5.85 G.
~~45.85~~ G. 47.45 G.

S/N 28 GROSS — 52.35 G.
TARE — 5.85 G.
NET — 46.50 G.

B/N 083079-2
S/N 29 GROSS — 51.60 G NO DET CORD
CONT./LID TARE — 5.85 G
NET 45.75 G

B/N 083079-2
S/N 30 GROSS 52.45 G NO DET CORD
CONT/LID TARE 5.85 G
NET 46.60 G

B/N 083079-2

S/N 31 GROSS 51.75 G
CONT./LID TARE 5.85 G NO DET CORD
NET 45.90 G

7/13/77 SMOKE CONTAINERS

B/N 083079-2

S/N 32 GROSS	52.90 G	NO DET CORD
CONT.+LID TARE	5.850	
NET	47.50 G	

B/N 083079-3

S/N 33 GROSS	51.75 G	NO DET CORD
CONT.+LID TARE	5.85 G	
NET	45.90 G	

B/N 083079-3

S/N 34 GROSS	52.75 G	NO DET CORD
CONT+LID TARE	5.85 G	
NET	46.90 G	

B/N 083079-3

S/N 35 GROSS	51.45 G	NO DET CORD
CONT+LID TARE	5.85 G	
NET	45.60 G	

B/N 083079-3

S/N 36 GROSS	52.10 G	NO DET CORD
CONT+LID TARE	5.85 G	
NET	46.25 G	

B/N 083079-3

S/N 37 GROSS	51.90 G	NO DET CORD
CONT+LID TARE	5.85 G	
NET	46.05 G	

7/2/79 SMOKE CONTAINERS 069

B/N 083079-3
B/N 38 GROSS 51,00 G
CONT.+LID TARE 5,85 G NO DET CORD
NET 45,15 G

B/N 083079-3
B/N 39 GROSS 52,05 G
CONT.+LID TARE 5.85 G NO DET. CORD
NET 46,20 G

B/N 083079-3
S/N 40 GROSS 51.50 G
CONT.+LID TARE 5,85 G NO DET. CORD
NET 45.75 G

B/N 083079-3
S/N 41 GROSS 52.90 G
CONT.+LID TARE 5,85 G NO DET. CORD
NET 47,05 G

B/N 083079-3
S/N 42 GROSS 53,00 G
CONT.+LID TARE 5,85 G NO DET. CORD
NET 47,10 G

B/N 083079-3 (29.10 G)
B/N 0831-1
S/N 43 GROSS 52.80 G
CONT.+LID TARE 5.85 G NO DET CORD
NET 46,95 G

9/13/79 SMOKE CONTAINER

B/N 083179-1

S/N 44 GROSS	54.60 G	
CONT & LID TARE	5.85 G	NO DET CORD
NET	48.75 G	

B/N 083179-1

S/N 45 GROSS	52.90 G	
CONT. + LID TARE	5.85 G	NO DET CORD
NET	47.05 G	

B/N 083179-1

S/N 46 GROSS	54.60 G	
CONT + LID TARE	5.85 G	NO DET CORD
NET	48.75 G	

B/N 083179-1

S/N 47 GROSS	54.30 G	
CONT. + LID TARE	5.85 G	NO DET CORD
NET	48.45 G	

B/N 083179-1

S/N 48 GROSS	53.50 G	
CONT. & LID TARE	5.85 G	NO DET CORD
NET	47.65 G	

B/N 083179-1

S/N 49 GROSS	55.40 G	
CONT. + LID TARE	5.85 G	NO DET CORD
NET	49.55 G	

9/17/79 SMOKE CONTAINER

B/N 083179-1

S/N 50	GROSS	52.35 G
CONTAINER+LID TARE		5.85 G
	NET	46.50 G

B/N 083179-1

S/N 51	GROSS	52.95 G
CONT+LID TARE		5.85 G
	NET	47.10 G

B/N 083179-1

S/N 52	GROSS	52.55 G
CONT+LID TARE		5.85 G
	NET	47.00 G

B/N 083179-2

S/N 53	GROSS	52.65 G
CONT+LID TARE		5.85 G
	NET	47.80 G

B/N 083179-2

S/N 54	GROSS	52.85 G
CONT+LID TARE		5.85 G
	NET	47.00 G

B/N 083179-2

S/N 55	GROSS	53.05 G
CONT+LID TARE		5.85 G
	NET	47.20 G

7/11/75 SMOKE CONTAINER

B/N 083179-2

C69

S/N 56	GROSS	52.75 G
CONT.+LID	TARE	5.85 G
	NET	46.90 G
S/N 57	GROSS	53.50 G.
CONT.+LID	TARE	5.85 G
	NET	47.65 G.
S/N 58	GROSS	52.75 G.
CONT. LID	TARE	5.85 G
	NET	46.5 G.
S/N 59	GROSS	51.60 G
CONT+LID	TARE	5.85 G
	NET	45.75 G.
S/N 60	GROSS	52.50 G.
CONT.+LID	TARE	5.85 G
	NET	46.65 G.
S/N 61	GROSS	52.45 G.
CONT+LID	TARE	5.85 G
	NET	46.6 G.

8/25/79 SMOKE CONTAINERS (PICATINNY SMOKE COMP.) 069

S/N 62 (B/N 083179-2)
GR. – 53.50 G.
T. – 6.05 G.
NET. – 47.45 G.

S/N 63 (27.5G. B/N 083179-2) (18.5G. B/N 083179-2)
GR. – 52.0 G.
T. – 6.0 G.
NET – 46.0 G.

S/N 64 (B/N 083179-3)
GR. – 51.50 G.
T. – 5.95 G.
NET – 45.55 G.

S/N 65 (B/N 083179-3)
GR. – 51.6 G.
T. – 6.0 G.
NET – 45.6 G.

S/N 66 (B/N 083179-3)
GR. – 51.2 G.
T. – 6.0 G.
NET – 45.2 G.

S/N 67 (B/N 083179-3)
GR. – 51.95 G.
T. – 5.90 G.
N. – 46.05 G.

S/N 68 (B/N 092479-1)
GR. – 52.1 G.
T. – 6.0 G.
NET – 46.1 G.

S/N 69 (B/N 092479-1)
GR. – 52.0 G.
T. – 6.0 G.
NET – 46.0 G.

S/N 70 (B/N 092479-1)
GR. – 52.35 G.
T. – 6.0 G.
NET – 46.35 G.

S/N 71 (B/N 083179-3)
GR. – 52.35 G.
T. – 6.0 G.
NET – 46.35 G.

S/N 72 (B/N 092479-1)
GR. – 51.85 G.
T. – 5.9 G.
NET – 45.95 G.

S/N 73 (B/N 092479-2)
GR. – 51.6 G.
T. – 5.9 G.
NET – 45.7 G.

S/N 74 (B/N 092479-2)
GR. – 51.7 G.
T. – 5.9 G.
NET – 45.8 G.

S/N 75 (B/N 092479-2)
GR. – 52.4 G.
T. – 6.0 G.
NET – 46.4 G.

S/N 76 (B/N 092479-2)
GR. – 51.8 G.
T. – 5.95 G.
NET – 45.85 G.

S/N 77 (B/N 092479-2)
GR. – 51.25 G.
T. – 5.9 G.
NET – 45.35 G.

S/N 78 (B/N 092479-2)
GR. – 51.95 G.
T. – 5.9 G.
NEW – 46.05 G.

S/N 79 (B/N 092479-2)
GR. – 51.3 G.
T. – 5.9 G.
NET – 45.4 G.

S/N 80 (B/N 092479-2)
GR. – 52.9 G
T. – 5.9 G.
NET – 47.0 G.

S/N 81 (B/N 092479-1)
GR. – 51.9 G
T. – 5.9 G.
NET – 46.0 G.

S/N 82 (B/N 092479-1)
GR. — 51.6G
T. — 6.0G.
NET — 45.6G.

S/N 83 (B/N 092479-1)
GR. — 52.4 G.
T. — 5.9G.
NET — 46.5G.

S/N 84 (B/N 092479-1)
GR. — 51.8 G.
T. — 5.9G.
NET — 45.9 G.

S/N 85 (B/N 083179-3)
GR. — 52.35 G.
T. — 6.0G.
NET — 46.35 G

S/N 86 (B/N
GR. — 51.9 G.
T. — 6.0G.
NET — 45.9 G.

S/N 87 (B/N 092479-1)
GR. — 51.95G
T. — 5.9G.
NET — 46.05G.

S/N 88 (B/N 092479-2)
GR. — 51.5G.
T. — 5.9G.
NET — 45.6 G.

S/N 89 (B/N 092479-2)
GR. — 51.8G
T. — 5.9G.
NET — 45.9 G.

S/N 90 (B/N 092479-2)
GR. — 52.0 G.
T. — 5.9G.
NET — 46.1 G.

S/N 91 (B/N 092479-2)
GR. — 51.7 G.
T. — 5.95G.
NET — 45.75 G.

S/N 92 (B/N 092479-2)
GR. — 51.5 G
T. — 5.95G.
NET — 45.55 G.

S/N 93 (B/N 092479-2)
GR. — 52.65G.
T. — 5.9G.
NET — 46.75 G.

S/N 94 (B/N
GR. — 51.7G.
TARE — 6.0G.
NET — 45.7G.

S/N 95 (B/N 092479-2)
GR. — 51.6G
T. — 5.9G.
NET — 45.7 G.

S/N 96 (B/N 092479-1)
GR. — 51.9G.
T. — 5.9 G.
NET — 46.0 G.

S/N 97 (B/N 083179-3)
GR. — 32.2 G.
T. — 4.4 G.
NET — 27.8 G.

S/N 98 (B/N 083179-3)
GR. — 31.4 G.
T. — 4.45 G.
N. — 26.95 G.

S/N 99 (B/N 083179-3)
GR. - 31.6 G.
T. - 4.55 G.
N. - 27.05 G.

TICKLE CONTAINER #1 GROSS – 253.90 G
TARE – 215.55 G.
38.35 G.

TICKLE CONTAINER #2 GROSS – 256.4 G
TARE – 217.1 G.
39.3 G.

" " #3 GROSS – 254.7
TARE – 216.3 G.
NET – 38.4

" " #4 GROSS – 252.8
TARE – 214.9 G.
NET 37.9

" " #5 GROSS – 257.8
TARE – 218.7 G.
NET – 39.1

" " #6 GROSS – 255.7
TARE – 217.9 G.
NET – 37.9

" " #7 GROSS – 94.20 G.
TARE – 63.35 G.
NET – 30.85 G.

" " #8 GROSS – 93.2 G.
TARE – 63.2 G.
NET – 30.0 G.

" " #9 GROSS – 94.05 G.
TARE – 63.6 G.
NET – 30.45 G.

9/11/79 PRACTICE FUSE TEST SERIES

S/N 020
MOD E 6 HOLE FUZE ⊖ HOLES
SMOKE CONTAINER - S/N 11 (PICATINNY SMOKE COMP.)
NO DET. CORD
44.11 GRAMS SMOKE COMP.

S/N 021
MOD E-1 6 HOLE FUZE ⊖ HOLES
SMOKE CONTAINER - S/N 15 (PICATINNY SMOKE COMP.)
WITH DET. CORD
46.95 GRAMS SMOKE COMP.

S/N 022
~~MOD E~~ 6 HOLE FUZE ⊖ HOLES
ORI SMOKE CONTAINER
119C

S/N 023
MOD E 6 HOLE FUZE ⊖ HOLES
ORI SMOKE CONTAINER
119B

S/N 024
MOD E-1 6 HOLE FUZE ⊖ HOLES
SMOKE CONTAINER - S/N 17 (PICATINNY SMOKE COMP.)
WITH DET. CORD
46.3 GRAMS SMOKE COMP.

S/N 025
MOD E-1 6 HOLE FUZE 6 HOLES PLUGGED
SMOKE CONTAINER - S/N 18 (PICATINNY SMOKE COMP.)
WITH DET. CORD.
46.6 GRAMS SMOKE COMP.
22 CC TICKLE

1/12/19 PRACTICE FUZE TEST SERIES 069

S/N 026
MODE 6 HOLE FUZE ⊖ HOLES
SMOKE CONTAINER - S/N 19 (PICATINNY SMOKE COMP)
NO DET. CORD
46.6 GRAMS SMOKE COMP.

S/N 027
MOD E-1 6 HOLE FUZE ⊖ HOLES
SMOKE CONTAINER - S/N 16 (PICATINNY SMOKE COMP.)
WITH DET. CORD
47.15 GRAMS SMOKE COMP.

S/N 028
ORI B 6 HOLE FUZE ⊖ HOLES
ORI SMOKE CONTAINER
119 B

S/N 029
ORI C 6 HOLE FUZE ⊖ HOLES
ORI SMOKE CONTAINER
119 C

S/N 030
MOD E-1 6 HOLE FUZE ⊖ HOLES
SMOKE CONTAINER - S/N 7 (PICATINNY SMOKE COMP.)
WITH DET. CORD
45.7 GRAMS SMOKE COMP.

S/N 031
MOD E 6 HOLE FUZE ⊖ HOLES
SMOKE CONTAINER - S/N 21 (PICATINNY SMOKE COMP.)
NO DET. CORD
49.0 GRAMS SMOKE COMP.

S/N 032
MOD E 6 HOLE FUZE ⊖ HOLES
SMOKE CONTAINER - S/N 20 (PICATINNY SMOKE COMP.
NO DET CORD
46.5 GRAMS SMOKE COMP.

7/12/79 PRACTICE FUZE TEST SERIES

S/N 033
MOD - E 3 HOLES PLUGGED
SMOKE CONTAINER - S/N 14 (PICATINNY SMOKE COMP.)
NO DET. CORD
46.85 GRAMS SMOKE COMP.

S/N 034
MOD - E 3 HOLES PLUGGED
SMOKE CONTAINER - S/N 22 (PICATINNY SMOKE COMP.)
NO DET. CORD
47.55 GRAMS SMOKE COMP.

S/N 035
MOD - E 6 HOLES PLUGGED
SMOKE CONTAINER - S/N 24 (PICATINNY SMOKE COMP.)
NO DET. CORD
46.9 GRAMS SMOKE COMP.

S/N 036
MOD - E 6 HOLES PLUGGED
SMOKE CONTAINER - S/N 23 (PICATINNY SMOKE COMP.)
NO DET. CORD
46.85 GRAMS SMOKE COMP.

S/N 037
6 HOLES Ø HOLES
ORI - C

S/N 038
6 HOLES Ø HOLES
ORI - C

S/N 039
3 HOLES PLUGGED
ORI - C

S/N 040
3 HOLES PLUGGED
ORI - C

S/N 041
6 HOLES PLUGGED
ORI - C

S/N 042
6 HOLES PLUGGED
ORI - C

2/29 PRACTICE FUZE TEST SERIES

S/N 043* NO FIRE?
MOD - E 6 HOLES PLUGGED
SMOKE CONTAINER - S/N 27 (PICATINNY SMOKE COMP.)
NO DET. CORD
47.45 GRAMS SMOKE COMP.
38.35 GRAMS TICKLE 22.3 CC

S/N 044
MOD - E . 6 HOLES PLUGGED
SMOKE CONTAINER - S/N 28 (PICATINNY SMOKE COMP.)
NO DET. CORD
46.5 GRAMS SMOKE COMP.
39.3 GRAMS TICKLE 22.4 CC

~~* S/N 043~~
~~MOD-E1 6 HOLES PLUGGED~~
~~SMOKE CONTAINER - S/N 25 (PICATINNY SMOKE COMP.)~~
~~WITH DET. CORD~~
~~47.5 GRAMS SMOKE COMP.~~
~~TICKLE~~

S/N 045
MOD-E1 6 HOLES PLUGGED
SMOKE CONTAINER - S/N 35 (PICATINNY SMOKE COMP.)
WITH DET. CORD
47.5 GRAMS SMOKE COMP.
38.35 GRAMS TICKLE

S/N 046
MOD-E 6 HOLES PLUGGED
SMOKE CONT. - S/N 30 (PICATINNY SMOKE COMP)
NO DET. CORD
46.6 G.

S/N 047
MOD - E 6 HOLES PLUGGED
SMOKE CONT. S/N 29 (PICATINNY SMOKE COMP.)
NO DET. CORD
45.75 G. SMOKE COMP.

S/N 048
MOD - E EXP. #98 WITH CAP REMOVED - CROSS BAR EXPOSED
SMOKE CONT. - S/N 31
NO DET. CORD
45.9 G. SMOKE COMP.

7/14/79 PRACTICE FUZE TEST SERIES

S/N 049
MOD - E ⊖ HOLES
SMOKE CONTAINER - S/N 39 (PICATINNY SMOKE COMP)
NO DET. CORD
46.6 GRAMS SMOKE COMP.

S/N 050
MOD - E ⊖ HOLES
SMOKE CONTAINER - S/N 48 (PICATINNY SMOKE COMP.)
NO DET. CORD
47.65 GRAMS SMOKE COMP.

S/N 051
MOD - E ⊖ HOLES
SMOKE CONTAINER - S/N 47 (PICATINNY SMOKE COMP.)
NO DET. CORD
48.45 GRAMS SMOKE COMP.

S/N 052
MOD - E ⊖ HOLES
SMOKE CONTAINER - S/N 36 (PICATINNY SMOKE COMP.)
NO DET. CORD
46.25 GRAMS SMOKE COMP.

S/N 053
MOD - E ⊖ HOLES
SMOKE CONTAINER - S/N 45 (PICATINNY SMOKE COMP.)
NO DET. CORD
47.05 GRAMS SMOKE COMP.

S/N 054
MOD - E - ⊖ HOLES - TICKLE
SMOKE CONTAINER - S/N 34 (PICATINNY SMOKE COMP.)
NO DET. CORD
46.9 GRAMS. SMOKE COMP.
TICKLE #5 - 39.1 GRAMS.

S/N 055
MOD - E - ⊖ HOLES - TICKLE
SMOKE CONTAINER - S/N 32 (PICATINNY SMOKE COMP.)
NO DET CORD
47.5 GRAMS SMOKE COMP.
TICKLE #4 - 37.9 GRAMS

1/14/79 PRACTICE FUZE TEST SERIES

S/N 056
MOD - E - Ø HOLES - TICKLE
SMOKE CONTAINER - S/N 35 (PICATINNY SMOKE COMP.)
NO DET. CORD
45.6 GRAMS SMOKE COMP.
TICKLE #3 - 38.4 GRAMS

S/N 057
MOD - E - Ø HOLES - TICKLE
SMOKE CONTAINER - S/N 33 (PICATINNY SMOKE COMP.)
NO DET. CORD
45.9 GRAMS SMOKE COMP.
TICKLE # 6 - 37.8 GRAMS

S/N 058
MOD - E - Ø HOLES - TICKLE
SMOKE CONTAINER - S/N 38 (PICATINNY SMOKE COMP.)
NO DET. CORD
45.15 GRAMS SMOKE COMP.
TICKLE #1 -

S/N 059 - Ø HOLES ORI - C

S/N 060 - Ø HOLES ORI - C

S/N 061 - Ø HOLES ORI - C

S/N 062 - Ø HOLES ORI - C

S/N 063 - Ø HOLES ORI - C

S/N 064
MOD-E ⊖ HOLES
SMOKE CONTAINER - S/N 42 (PICATINNY SMOKE COMP.)
NO DET. CORD
47.1 GRAMS SMOKE COMP.

S/N 065
MOD-E ⊖ HOLES
SMOKE CONTAINER - S/N 41 (PICATINNY SMOKE COMP.)
47.05 GRAMS SMOKE COMP.
NO DET. CORD

S/N 066
MOD-E ⊖ HOLES
SMOKE CONTAINER - S/N 44 (PICATINNY SMOKE COMP.)
48.75 GRAMS SMOKE COMP.
NO DET. CORD

S/N 067
MOD-E ⊖ HOLES
SMOKE CONTAINER - S/N 37 (PICATINNY SMOKE COMP.)
46.05 GRAMS SMOKE COMP.
NO DET. CORD

S/N 068
MOD-E ⊖ HOLES
SMOKE CONTAINER - S/N 40 (PICATINNY SMOKE COMP.)
45.75 GRAMS SMOKE COMP.
NO DET. CORD

S/N 069
MOD-E ⊖ HOLES
SMOKE CONTAINER - S/N 43 (PICATINNY SMOKE COMP.)
46.95 GRAMS SMOKE COMP.
NO DET. CORD

S/N 070
MOD-E ⊖ HOLES
SMOKE CONTAINER - S/N 49 (PICATINNY SMOKE COMP.)
49.55 GRAMS SMOKE COMP.
NO DET. CORD

1/17/79 PRACTICE FUZE TEST SERIES

S/N 071
MOD - E Ø HOLES
SMOKE CONTAINER - S/N 46 (PICATINNY SMOKE COMP.)
48.75 GRAMS SMOKE COMP.
NO DET. CORD

S/N 072
MOD - E Ø HOLES
SMOKE CONTAINER - S/N 50 (PICATINNY SMOKE COMP.)
46.5 GRAMS SMOKE COMP.
NO DET. CORD

S/N 073 Ø HOLES
SMOKE CONTAINER - S/N 51 (PICATINNY SMOKE COMP.)
47.1 GRAMS SMOKE COMP.
NO DET. CORD

S/N 074 Ø HOLES JOHN
[redacted] ORI - C SMOKE

S/N 075 Ø HOLES
[redacted] ORI - C SMOKE

S/N 076 Ø HOLES
ORI - C SMOKE

S/N 077 Ø SMOKE
ORI - C SMOKE

S/N 078 [redacted] Ø HOLES
ORI - C SMOKE

S/N 079 Ø HOLES
ORI - C SMOKE

S/N 080 Ø HOLES
ORI - C SMOKE

S/N 081 Ø HOLES
ORI - C SMOKE

S/N 082 Ø HOLES
ORI - C SMOKE

S/N 083 - Ø HOLES
ORI - C SMOKE

S/N 084
MOD - E ⊖ HOLES [redacted]
SMOKE CONTAINER - S/N 53 (PICATINNY SMOKE COMP.)
NO DET. CORD
47.8 GRAMS SMOKE COMP.
[redacted]

S/N 085
MOD - E ⊖ HOLES [redacted]
SMOKE CONTAINER - S/N 60 (PICATINNY SMOKE COMP)
NO DET CORD
46.65 GRAMS SMOKE COMP.
[redacted]

S/N 086
MOD - E ⊖ HOLES TICKLE
SMOKE CONTAINER AND TICKLE CONTAINER MODIFIED
SMOKE CONTAINER - S/N 97 (PICATINNY SMOKE COMP.)
NO DET. CORD
27.8 G. GRAMS SMOKE COMP.
30.85 G. GRAMS TICKLE (TICKLE S/N 7)

S/N 087 ⊖ HOLES TICKLE MOD - E
SMOKE CONTAINER AND TICKLE CONTAINER MODIFIED
SMOKE CONTAINER - S/N 98 (PICATINNY SMOKE COMP.)
NO DET. CORD
26.95 G. SMOKE COMP.
30.0 G. TICKLE (TICKLE S/N 8)

S/N 088
MOD - E ⊖ HOLES TICKLE
SMOKE CONTAINER AND TICKLE CONTAINER MODIFIED
SMOKE CONTAINER - S/N 99 (PICATINNY SMOKE COMP.)
NO DET. CORD
27.05 G. SMOKE COMP.
30.45 G. TICKLE (TICKLE S/N 9)